ELECTRICAL REVIEW

AN ILLUSTRATED WEEKLY JOURNAL OF SCIENTIFIC AND ELECTRICAL PROGRESS.

VOL. 35. No. 15. WEEKLY. | NEW YORK, WEDNESDAY, OCTOBER 11, 1899. | $3 PER ANNUM. SINGLE COPIES, 10 CENTS.

Copyright, 1899, by ELECTRICAL REVIEW PUBLISHING COMPANY, Times Building, 41 Park Row, New York. Entered at the Post Office, New York, as Mail Matter of the Second Class.

VIEWS, NEWS AND INTERVIEWS

The recent Dewey celebration in New York city proved extremely profitable to the local traction companies, all of them breaking records. On September 28 the Metropolitan Street Railway Company carried 1,119,000 cash passengers, or 215,000 more passengers than the system had ever before handled in one day. On the following day it handled 1,304,380 persons, and on Saturday 1,019,440. On October 1 the road carried 711,480 people. On the Third avenue line the increase of passenger traffic for September 28, 29 and 30 was 572,000. The receipts of the Brooklyn Rapid Transit Company for September 29 and 30 were close to $75,000.

Sao Paulo, Brazil, a city of 250,000 inhabitants, about 40 miles from the sea coast, is to have an electric railway system. An American syndicate, with $10,000,000, has secured valuable concessions, and has formed the Sao Paulo Railway, Light and Power Company, Limited.

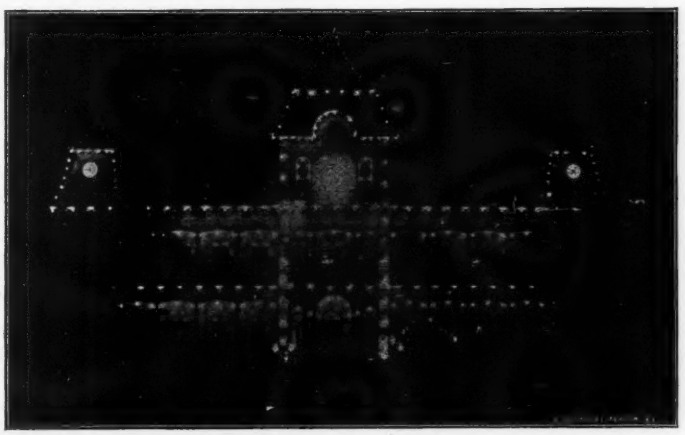
At New Brunswick, N. J., the merchants of the city are trying an interesting experiment in economics. A large number of trolley lines enter the city from various nearby points, and the merchants propose to give free excursions on all of them to the city on certain days. Every one wishing a free trip pays his fare and secures a ticket from the conductor which entitles him to a rebate from any of the business men who are paying for the excursion. It is not incumbent upon the people to buy anything at the stores where they get their rebates, but, of course, the business man hopes to have a boom in trade from the large number of visitors in town.

The Erie Canal Electric Traction Company was organized recently to introduce electricity as a motive power, not only upon the Erie Canal, but upon all the canals in the United States and upon the canals of France and Holland. It possesses patents applying electricity to a motor or tractor which, from the tow-path, so it is said, will propel or tow six ordinary canal boats of 240 tons each five miles an hour. The capital of the company, amounting to $5,000,000, has been underwritten by a Wall street syndicate.

Mr. E. S. Martin writes in *Harper's Weekly* as follows: "In remarking the other day on the increasing use in print of the word 'rig' as a synonym for 'vehicle,' curiosity was expressed as to whether this upstart word was applicable to automobiles. It appears that it is. The Boston *Transcript*, in its account of the automobile parade at Newport on September 8, speaks of 'floral decorated rigs,' 'Mrs. Belmont's rig,' and 'the rig driven by Mrs. Meyer.'

"The use of 'wheel' for bicycle is bad enough. Is life so short in this country that the brevity of 'rig' is to prove its sufficient recommendation? The word is in use on the signs of some livery-stables in New York, but then sign-board English knows neither law, dictionary, spelling book, nor grammar."

A press telegram from Boston states that letters have been received in that city from residents of Cape Cod, who said that they distinctly heard the cannonading that took place in New York on Friday, September 29, during the Dewey celebration. It sounded like the rumbling of distant thunder, but continued at intervals for some time, each time with about the same amount of noise, and always from the same direction. At the Massachusetts Institute of Technology, a professor, who is an authority on sound waves, was asked if the saluting could have been heard at so great a distance. He replied that it was not at all impossible, as in many cases sound had been heard on the water at much greater distances than from New York to Cape Cod, which are perhaps 250 miles apart.



ELECTRIC ILLUMINATION OF THE GOVERNMENT BUILDING AT HONOLULU, HAWAIIAN ISLANDS.

The Yaqui Indians in Mexico are at present causing much trouble in the northern part of that country by their depredations and warlike attitude. A press telegram states that Jose Gonzales, chief constructor of Federal telegraph lines in Sonora, has arrived at Ortiz, after an eventful trip through the Yaqui country. Starting from a point near the mouth of the Yaqui River, Gonzales and his party traveled up the valley over 200 miles, finding that the telegraph wires had been cut at a number of places. North of Cocorl over twenty-five miles of poles had been destroyed and the wire carried off. While they were at work on repairs, attacks were made by Yaquis, and three Mexican soldiers were killed. Gonzales and his party came across five American miners near Soyopa and escorted them out of the hostile country.

Electric Illumination of the Government Building, Honolulu.

Victor Hugo prognosticated that the nineteenth century would witness the unification of the whole world, when wars would cease and universal peace and brotherhood prevail. American citizens may justly claim to be active agents in this beneficent work. Expansionists are not without their opponents, but the opposition arises rather from objections to the methods employed than from objections to the principles involved.

One of the early results of the expansion policy of the United States has been the acquisition of the Hawaiian Islands. The illustration accompanying this article shows the government building at Honolulu, illuminated on the night of the Fourth of July, of this year. The electric current was supplied by the Hawaiian Electric Company, from a 250-kilowatt Westinghouse generator, two-phase, 1040 volts, at 7,200 alternations. Already electric lighting has become very popular in Honolulu. The arc lamps interspersed among the tropical trees which line the streets produce artistic effects almost unequaled.

The opponents of the expansion policy may find solace in the contemplation of the illustration of the illuminated government building at Honolulu, in noting how beautifully the light shed by American mechanism illuminates the darkness in a country hitherto plunged in archaism, and, lastly, that the change has been introduced peaceably.

A Direct-Current Power Transmission.

The Compagnie de l'Industrie Electrique has commenced work on the machines for the important St. Maurice–Lausanne power transmission in Switzerland. The line will be 68 kilometers (42 miles) long, and 10,000 horse-power will be sent over it. Direct current at a maximum pressure of 25,000 volts will be used, the machines generating a constant current at variable voltage; they are, practically, large arc machines.

NOTES ON POWER-STATION ECONOMIES.—I.

BY MAURICE HOOPES.

In these days, when engineers in charge of railway and electric lighting power-stations are spending their best efforts towards economy of operation, and when the whole subject has received so much attention and gone through such a very considerable advancement, it seems almost superfluous to undertake to add information to that that has already been published. The writer, therefore, feels that in giving results of his experience in these matters he is likely to mention methods of operation that are quite familiar to a majority of operating engineers.

The three principal translating devices of an ordinary power-station are the boilers, the engines and the generators. Of these the generators have nearly fixed efficiencies, and there is very much less opportunity for variation in these efficiencies, due to different methods of handling, than there is with the boilers and engines. There is little to be done in the way of adjustment on the ordinary generator. The defects in it which influence its operation are usually very evident and easily detected. This can not be said of either the boilers or the engines, as there are many ways that energy may be wasted in each of these devices without the waste being evident to any but a very careful investigator.

Inasmuch as coal is the principal material used in a power-station, it would seem that its purchase should receive a great deal of careful attention. It is quite worth while to weigh all coal received in the power-station where it is delivered in such condition as makes this possible The writer's experience has indicated that it is possible to save materially at times by checking up the weights of the dealer furnishing coal.

In every well conducted test of coal, the amount of moisture contained in the coal is determined and deducted in ascertaining the net weight of coal used. It is quite as important that this determination should be made as relating to the coal regularly supplied to boilers. Coal which is stored in the open air, and the vehicles carrying the coal into the boiler-room loaded from the surface of the pile, may contain seven or eight per cent of moisture after a period of rain. It has been the writer's practice, in buying coal for the stations of which he has had charge, to specify that the moisture shall not exceed 2½ per cent. To determine this, a small quantity of coal of the average size is taken from each load brought in during the day. This is mixed together, and from this 50 pounds is taken and spread out in an open pan. This is placed on top of the boilers, in a place that is not warm enough to drive the gases from the coal, and allowed to remain there 24 hours. It is then weighed again, and the percentage of moisture determined from the shrinkage. These percentages obtained daily are averaged for the month, and, if the average exceeds 2½ per cent, a deduction equivalent to the excess is made from the monthly bill for coal. The utility of this has been indicated very forcibly by considerable allowances made on coal stored out of doors in wet weather. There is no difficulty with coal stored under cover, as it comes from the mines with usually something less than 2½ per cent of moisture, and dries out somewhat during storage.

It is, of course, advisable to weigh all of the ash that is taken from boilers, and thus obtain the percentage of ash in all of the coal furnished throughout the year. While this does not indicate the value of the coal so well as does an evaporating test, it is of great assistance in comparing various coals.

The best test of coal is the determination of the quantity of water a given quantity of coal will evaporate. In order to compare different coals, it is, of course, necessary to test them under the same or similar boilers, that all conditions of the various tests may be similar. Nearly every power-station of any size has, at some time or other, made tests of the evaporative efficiencies of its boilers and of the various coals. It is not usual, however, for power-stations to get accurate figures each day indicating the day's result as to the number of pounds of water evaporated per pound of coal used. As these daily results are of very much greater value than any special results obtained by short-time tests, it is rather surprising that it is not more generally the practice to obtain them. Nearly all well managed power-stations weigh accurately the coal fed to the boilers each day or each watch. Few, however, have reliable means of measuring water consumed by the boilers. Water meters are used for this purpose quite extensively, but, as is well known, the best of them is liable to a very considerable error. They require frequent testing and overhauling to keep them in anywhere nearly satisfactory condition, and the engineers attempting to use them and keep them accurate soon give the attempt up in disappointment.

The stations which the writer has been operating were each equipped with large wooden storage tanks for the purpose of holding boiler-feed water, in the event of a failure of the city supply. These tanks were made to serve the purpose of measuring the water fed to the boilers. During the hours between two and four o'clock in the morning, when the station was running with its lightest load, the boilers were fed through a water meter, and the feed water furnished during this period measured in this way. As this water was a very small proportion of the whole day's supply, a considerable error in the meter was reduced to a very inconsiderable one when made a part of the whole day's service. During this time, when the boilers were being fed by water drawn through the meter, the storage tank was being filled. When the tank was filled the feed pumps were shut off from the auxiliary meter, which had been measuring the boiler feed, and were connected to the tank and continued feeding water from the tank throughout the remainder of the day.

These tanks had been calibrated as follows: A scale was placed vertically on the outside of the tank. To a small pet cock, tapped in the side of the tank near the bottom, a rubber tube was connected, and in the end of this tube a boiler water-gauge glass was inserted. This glass, held against the scale on the outside of the tank, indicated the level of the water in the tank. The tank was filled and the level noted on the scale. Then through a large valve, piped into the bottom of the tank, water was drawn into a hogshead mounted on a pair of scales. The scales had been accurately calibrated, and it was possible to make a very careful measurement of the water drawn from the tank. After 1,000 pounds had been drawn in this way, a mark was made on the scale, and in the same manner each 1,000 was noted until the tank was emptied. The level of the water in the tank could be transferred to the scale by means of the tube and glass very much more accurately than with a float and weight. With the latter, the friction of the pulleys, over which the chain or cord connecting the float with the weight was led, would prevent the weight coming to the exact position indicating the level of the water. For this reason the glass and tube were found preferable and almost as convenient. By feeding the boilers from this tank a very accurate measurement of the water consumption was had, and, with an equally careful weighing of coal, the data were at hand for an accurate determination of the number of pounds of water evaporated per pound of coal during the run. When these figures are had for each day and totalized for the month and again for the year, they are extremely valuable. They form the only reliable means of comparing various coals, and they likewise indicate any improper condition of the boilers.

An Error in Mr. Lockwood's Paper.

TO THE EDITOR OF ELECTRICAL REVIEW:

I observe that in your issue of October 4 you reprinted the paper written by me for the Wilmington meeting of the Association of Railway Telegraph Superintendents, and entitled "Some Instances of Composite Transmission and Compound Telephony."

I desire to call attention to the circumstance that the illustrative sketches marked respectively Fig. 5 and Fig. 10 have got themselves mixed up, and should have both their positions and numbers changed.

That is to say, the diagrams now respectfully marked Figs. 5 and 10 should, to correspond with the text, have both their numbers and places transposed, each taking the number and place of the other.

By publishing this corrective note, you will greatly oblige.

THOMAS D. LOCKWOOD.

Boston, October 6.

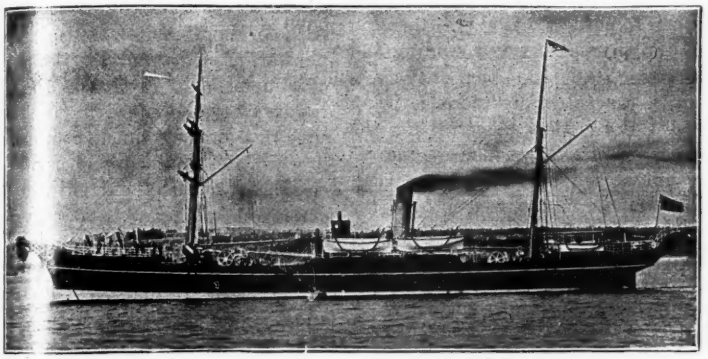
The Ohio Electric Light Association's Fifth Annual Meeting.

On Tuesday and Wednesday of this week the fifth annual meeting of the Ohio Electric Light Association took place at Cleveland. The sessions were held in the rooms of the Associated Technical Clubs of Cleveland, beginning Tuesday morning. In the afternoon papers were read by Messrs. George Huyler, Jr., and Leon Le Pontois. On Wednesday Messrs. M. E. Turner, H. W. Hillman and H. G. Reist read papers. The usual hospitalities of the electric railway, light and supply companies were extended to the visitors.

AN OCEAN TELEGRAPH STATION.

EXCELLENT FACILITIES PROVIDED FOR PROMPTLY REPORTING THE YACHT RACES.

Recognizing the importance to the public of prompt news of the international yacht races, the Commercial Cable Company, working in conjunction with the Postal Telegraph-Cable Company, established an ocean telegraph station near the yacht course, from which messages to all parts of the world could be promptly sent. This station was the Commercial Cable Company's fine cable-ship Mackay-Bennett, which was anchored near the Sandy Hook lightship, about nine miles out in the Atlantic Ocean from Coney Island.



THE COMMERCIAL CABLE COMPANY'S CABLE-SHIP MACKAY-BENNETT.

A special double-core cable had been laid by the ship from Coney Island to the anchorage near the lightship. During the races the sea end of the cable was attached to a telegraph office located on the main deck of the Mackay-Bennett, and the cable was in constant connection with the main cable and telegraph systems of the Commercial and Postal companies. Press despatches and other telegrams and cablegrams were accepted at the regular rates at this ocean telegraph office, and were signaled direct from the ship.

Both cores of the cable were quadruplexed, and eight operators were at work in the telegraph office on the cable-ship, which was improvised for the occasion from an old sail and a few boards.

The day of the first race, about 50 newspaper men, among them a representative of the ELECTRICAL REVIEW, were entertained on the Mackay-Bennett by the Commercial and Postal companies. All the news of the race, as seen from this point, was quickly sent, a stream of telegrams pouring constantly into the office.

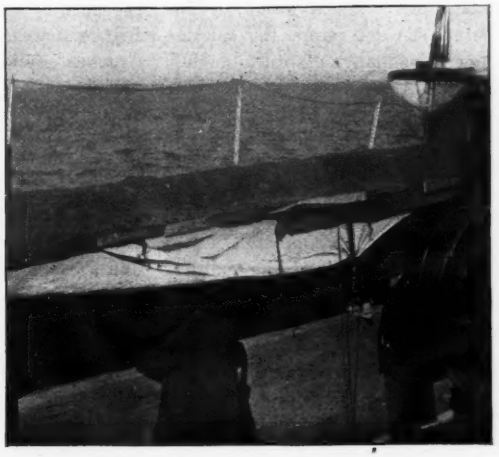
As chronicled in the ELECTRICAL REVIEW last week, one of the Marconi wireless telegraph stations was on the Mackay-Bennett, at which 60 bulletins were received. These were read off a tape recorder, written down by hand, carried from the chart-house to the telegraph office on the main deck and wired from there to the New York *Herald*. The whole operation required but little time, as a corps of messenger boys was on duty in all parts of the ship.

Despatches were also received from tugs carrying newspaper men. The bulletins would be written out by the men on the tugs and placed inside a small rubber football, which was then inflated and sealed. The tug would steam up to the Mackay-Bennett, which would heave a light line to the tug. The line was made fast to the ball and hauled aboard. In this way the despatches were kept dry, and were easily put aboard the cable-ship.

Captain Schenk is in command of the Mackay-Bennett and Mr. C. Priest is her chief electrician. The ship makes her headquarters at Halifax, which is the nearest central point from which to start on cable repairing or cable laying expeditions. Her equipment is complete in every respect, and she is fitted up much like a yacht. The Mackay-Bennett is probably the finest and best equipped vessel of her kind afloat. On the day of the first race, October 3, the following officials of the Commercial and Postal companies were present on the ship to welcome the newspaper men: W. H. Baker, general manager of the Postal company; Minor M. Davis, traffic manager of the Postal company, and in charge of the telegraph office on the Mackay-Bennett; S. F. Jones and Arthur Brown, of the Postal's electrical department.

The ship was in charge, for the day, of Charles E. Merrett, cashier of the Commercial Cable Company, who represented Geo. G. Ward, vice-president and general manager of the company. Mr. Charles Cuttriss, chief electrician of the Commercial Cable Company, and Mr. S. F. Austin, of the executive department, were also present.

NEWSPAPER CORRESPONDENTS WATCHING THE YACHT RACES FROM THE CABLE-SHIP MACKAY-BENNETT.



NEWSPAPER CORRESPONDENTS SENDING DESPATCHES FROM THE CABLE-SHIP MACKAY-BENNETT.

SCENES ON AN OCEAN TELEGRAPH STATION.

Seventy-Fifth Anniversary of the Franklin Institute.

The seventy-fifth anniversary of the Franklin Institute, of Philadelphia, was celebrated last week, the various sections meeting upon each of six days at the National Export Exposition, the members being provided with special tickets. A luncheon was served on Saturday evening as a finish to the week's work. Dr. A. E. Kennelly read the presidential address in the section on physics and astronomy.

The electrical section of the Institute met on the evening of October 3, with Professor George A. Hoadley in the chair. Dr. Edwin J. Houston read an address on "The Seventy-fifth Anniversary of the Franklin Institute from an Electrical Standpoint." Dr. Houston traced the progress of electrical science, and noted the fact that the Franklin Institute was founded about the time electrical activity began to experience its marked progress. Speaking of the work of the electrical section, he referred to the International Electrical Exposition of 1884, which was held at the suggestion of the electrical section, and was limited strictly to the examination of electrical devices and appliances.

Mr. Ralph W. Pope, of New York, secretary of the American Institute of Electrical Engineers, delivered an address on "The Influence of Technical Societies in Promoting the Progress of the Arts." Mr. Pope, in the course of his remarks, called attention to what he believed to be an apparent omission in our educational system. He said that scientific and engineering societies would be better supported if students were more thoroughly trained at an early age in elementary physics; that the prevailing ignorance in such matters was responsible for the existence of a class of alleged inventors who devised schemes for obtaining money under false pretences.

Mr. Pope gave the Franklin Institute the credit for the organization under government auspices of the National Conference of Electricians in 1884. Also the credit of the publication, in its journal, of the proceedings of the International Electrical Congress, in 1893, whose records would otherwise have been hidden from the world.

The meeting closed on Saturday evening, October 7, with a paper by Rear-Admiral George W. Melville on "The Modern Warship, as Combining in Itself the Highest Results of Skill, Ingenuity and Scientific Knowledge."

SCIENCE BREVITIES.

Masses Smaller than Atoms—At the recent meeting of the British Association Professor J. J. Thomson read a paper giving an account of recent researches on the existence of masses smaller than atoms, in which he pointed out that several lines of investigation lead to a determination of the ratio of the mass of an atom to the electric charge conveyed by it. These are (1) ordinary electrolysis; (2) experiments on the velocity of charged particles; (3) experiments on the velocity of cathode discharges. The result of these experiments indicates that the charge carried by an atom in cathode discharges and similar phenomena is apparently 1,000 times greater than in ordinary electrolysis. It follows either that the atoms become dissociated and only a portion of their mass carries the negative charges of cathode rays, or else that the atom can receive a greater charge than is assigned to it in explaining electrolytic phenomena: either the mass is smaller or the charge greater than in the case of electrolysis. The author described a method of discriminating between these two assumptions by determining separately the charge carried by a known number of atoms, in a case for which the charge per unit mass has the greater value. The method used consists in deflecting by a magnetic field the paths of particles which convey the negative charge from a flat plate to a close parallel one, under the action of ultra-violet light. A flat metal plate, negatively electrified, is brought near to a very large perforated metal plate through which ultra-violet radiation can pass, the whole apparatus being enclosed in gas at a pressure of about $\frac{1}{100}$ millimetre of mercury. The radiation causes a discharge of electrified particles from the negative plate, which move in parallel straight lines to the perforated plate which receives their charge. If now a magnetic field be set up between the plates, its direction being parallel to the plane of the plates, the paths of the particles become curved; in fact, cycloids, and the particles may not reach the perforated plate if the latter is far enough away from the negative plate. There will, therefore, be a diminution in the rate of discharge, which is the phenomenon actually observed; its amount corresponds with theory if we assume the large value of the charge per unit mass. The magnitude of the phenomenon is the same in all gases and the same for ultra-violet and cathode rays. Similar results are obtained for observing the negative charges leaving an incandescent electric filament of carbon in an atmosphere of hydrogen in a magnetic field. The amount of charge carried by an atom depends on the gas and on the nature of the electrodes. It would appear from this, although he put the theory forward with diffidence, that electrification seems to consist in the removal from an atom of a small corpuscle, the latter consisting of a very small portion of the mass of the atom with a negative charge, while the remainder of the atom possesses a positive charge. This assumption favors Prout's hypothesis that the mass of an atom is not invariable, a supposition confirmed by the recent spectroscopic determinations of Lockyer and others. M. Broca described some experiments confirming the conclusions of Professor Thomson. He had obtained, in a Crookes vacuum-tube, with small platinum electrodes half a millimetre apart, an actual spark. The metal from the anode deposited on the walls of the tube and its path could be deflected by a magnetic field, as if it carried a positive charge. Spectroscopic analysis of the spark near the two electrodes confirmed Professor Thomson's results.

Quantitative Investigation of the Coherer—To determine the relation between the change of resistance in a coherer and the quantity of electricity traversing it, Professor A. Trowbridge used a coherer made of bicycle balls, and discharged through it a subdivided condenser charged by a variable storage battery, says an abstract in the *Electrician*. He was thus enabled to control the quantity of electricity as well as the capacity and potential. The initial resistance of the coherer was kept constant at 2,000 ohms. The reduction of the resistance was not the simple function of the quantity of electricity that had been expected. For any given quantity, the larger the charging potential (and the smaller the capacity) the greater was the conductivity attained on discharge. Every coherer has, moreover, a critical difference of potential below which it does not react. In the case of the coherer used this was about 8 volts. A coherer with its vertical wire and earth connection can be regarded as part of the discharge circuit of a condenser whose plates are the vertical wire and the earth. A certain potential difference between vertical wire and earth is caused by the electro-magnetic waves sent out from the Herz oscillator; this potential and the capacity of the vertical-wire-earth condenser determine the quantity of electricity which is discharged through the coherer in the form of an aperiodic impulse and which produces the lowering in resistance necessary to wireless telegraphy. The potential difference on opposite sides of the coherer must be an inverse function of the distance between sending and receiving stations; if this distance is small, the potential difference being above the critical potential for the coherer used, if we increase the capacity of the vertical wire we shall increase the fall in resistance of the coherer, but if the distance is so great that the potential is at about its critical value, then an increase in capacity would lower the potential and so diminish or destroy the sensibility of the coherer. This would explain Marconi's statement that at short distances a capacity consisting of a cubical tin box, mounted at the top of the vertical wire, increased the sensibility of the coherer, but that he found it advisable to omit this capacity when telegraphing long distances.

Solidification of Hydrogen—A paper by Professor Dewar on the solidification of hydrogen, in the absence of the author, was read at the recent British Association meeting by Sir W. Crookes. Solid hydrogen presents the appearance of frozen water, and not, as has been anticipated by many, that of frozen mercury. The temperature of the solid is 16 degrees absolute at 35 millimetres pressure, and it melts at 16 or 17 degrees absolute, the practical limit of temperature obtainable by its evaporation being 14 or 15 degrees absolute. Dr. Ludwig Mond said it was gratifying to learn not only that Professor Dewar had achieved this great result, but that he was still alive to tell the tale, for the danger incident to the experiment was considerable. Dr. Gladstone remarked on this great triumph of Professor Dewar, hydrogen being the last of the old gases that remained to be solidified. Sir W. Crookes pointed out that the great danger in these experiments resulted from the leakage in of air, which made an explosive mixture with the hydrogen; furthermore, during the passage of the dry gas through the narrow tubes it became electrified, and in some instances sparking occurred with most violent detonation. Sir William also announced that Professor Dewar had succeeded in liquefying helium by means of liquid hydrogen, an announcement that was received with acclamation. The hydrogen for these experiments was obtained by the action of pure sulphuric acid on pure zinc.

X-Rays and Fuel Impurities—X rays having been utilized in surgery, are now finding their place in industrial work, and M. Couriot, the professor of mining at the Ecole Centrale des Arts et Manufactures, Paris, has applied them in determining the purity of mineral fuels. It is said that the results can be obtained in much less time than by the ordinary combustion process, and that a number of coal companies on the Continent are also employing radiographic apparatus in the examination of the fractures produced in mine accidents. Coal can be traversed by the Roentgen rays, but silicates of lead and potassium and rock crystal are not permeable. Consequently, the slates of the coal measures, which are composed mainly of silicate of alumina, and the sandstones of the coal measures are impermeable to the rays. If a piece of coal with slight rock stratifications be examined, a whole series of different shades may be observed, due to variations in the composition of the substance. The form of the apparatus employed has been described by M. Couriot in a communication to the Société de l'Industrie Minerale, Sainte Etienne.

Curious High-Frequency Phenomena—Herr H. Himstedt described in a recent number of *Wiedemann's Annalen* some curious high-frequency effects he had noticed. If one pole of the secondary of a Tesla coil is connected to a point and the other to a disk, the two being separated to such a distance that sparks do not pass, the disk exhibits a positive charge in air or in oxygen and a negative charge in all other gases. These results are independent of the direction of the primary current of the coil. In later experiments he found that the disk was charged positively, negatively or remained discharged according to the distance between it and the point. To explain these phenomena the author supposes that a sharp point under these conditions emits more positive electricity than negative, and that negative electricity can be transmitted further through the atmosphere than positive.

Bequest To a Technical Institution.

The Rose Polytechnic Institute at Terre Haute, Ind., will shortly receive $50,000 from a bequest of the late Joseph Collett, the payment of which has been delayed through litigation.

Street Railway Men Will Meet in Chicago Next Week.

The American Street Railway Association will hold its annual convention in the western metropolis, October 17, 18, 19, 20. A large attendance is expected and a fine exhibition assured.

This most important gathering of the traction field is to be held in Chicago next week, with headquarters at the Auditorium Hotel. It is the convention of the American Street Railway Association, and its proceedings will be of interest and importance.

The officers of the association are the following-named gentlemen:

President: Charles S. Sergeant, second vice-president Boston Elevated Railway Company, Boston.

First vice-president: Henry C. Moore, president Trenton Street Railway Company, Trenton, N. J.

Second vice-president: Ernest Woodruff, president Atlanta Consolidated Street Railway Company, Atlanta, Ga.

Third vice-president: Walton H. Holmes, general manager Kansas City Railway Company, Kansas City, Mo.

Secretary and treasurer: Thomas C. Pennington, treasurer Chicago City Railway Company, Chicago, Ill.

Executive committee: Albion E. Lang, president Toledo Traction Company, Toledo, Ohio; George E. Yuille, second vice president of the West Chicago Street Railroad Company, Chicago, Ill.; Frank Jones, president Memphis Street Railway Company, Memphis, Tenn.; John I. Beggs, general manager Milwaukee Railway and Light Company, Milwaukee, Wis.; Ira McCormack, general superintendent Brooklyn Heights Railroad Company, Brooklyn, N. Y.

The programme promises to be of interest, and papers will be read on the following subjects:

"Maintenance of Car Equipment."

"Modern Street Railway Shops, Their Design, Machinery and Shop Practice."

"Train Service and Its Practical Application."

"Investments in Street Railways. How Can They Be Made Secure and Remunerative?"

"Construction and Maintenance of Street Railway Tracks."

The following resolution was adopted at a meeting of the executive committee held in Chicago, February 6, 1899:

Resolved, That the last day of the convention, Friday, October 20, be set apart for the systematic and careful inspection of exhibits by the delegates, and that all street railway managers be urged to send delegations from their mechanical, operating and accounting departments to inspect the same.

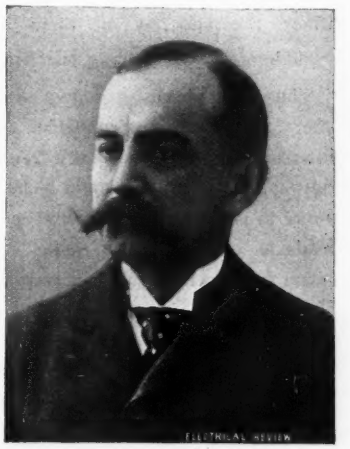
THE EXHIBITION.

All branches of the electric railway and supply business will be represented in the exhibition next week. The representatives of the ELECTRICAL REVIEW have learned of the following exhibits which will be in evidence, and its readers who are interested in electric railways are cordially invited to inspect them:

The R. Bliss Manufacturing Company, of Pawtucket, R. I., will exhibit different varieties of car-gates for street, elevated and steam cars. They will also have on exhibition a gate operated by compressed air.

The Okonite Company, Limited, of New York, will have an exhibit of its wires and cables in connection with its western representative, the Central Electric Company, of Chicago.

The Taunton Locomotive Manufacturing Company, of Taunton, Mass.,



MR. C. S. SERGEANT, OF BOSTON, PRESIDENT AMERICAN STREET RAILWAY ASSOCIATION.

will show snow-sweepers, one double-track share-plow and one standard nose-plow. Although crowded with work this company expects to have this exhibit ready in time for the convention.

The Bibber-White Company, of Boston, Mass., will have an exhibit in conjunction with the Messrs. Leschen-Macomber-Whyte Company, of Chicago, which will be in charge of Mr. H. W. Smith; it is claimed that Mr. Smith is able to give out more information than any other three men in the exhibition hall.

The Gold Street Car Heating Company, of New York, will exhibit a very complete line of electric heaters, including several styles of the most improved types of Gold's electric heaters.

The Siegrist Lubricator Company, of St. Louis, will be represented by Mr. J. N. Edelin, and will show its automatic duplicate oiling tables, automatic sight-feed lubricators and automatic pressure oil cups. If this company can secure steam its exhibit will be operative.

The National Carbon Company, of Cleveland, will be on hand in full force at the convention.

William Wharton, Jr., & Company, Incorporated, of Philadelphia, will present samples of their manganese steel special work; unbroken main-line switch and novelties, such as frogs and mates for T-rail work, solidly cast of manganese steel; double-spring rail frogs for suburban roads; the Nichols patent tongue switch, with protected heel; two novel constructions of crossings of street railways over steam railroads, in which manganese steel is prominent, one of the styles being particularly adapted for paved city streets. The company will be represented by F. P. Howe, first vice-president; V. Angerer, second vice-president, and others.

Leschen-Macomber-Whyte Company, of Chicago, will exhibit insulated wire and cables, trolley wire, feeder wire and street railway material generally, manufactured by the Bibber-White Company, of Boston.

The Morris Electric Company, of New York, will be represented by Mr. Elmer P. Morris, treasurer, and Mr. Geo. C. Ewing, president. They have secured ample space there, and it is their intention to out-do themselves. They will represent the following companies, showing goods of their manufacture:

Electric Railway Equipment Co., poles, etc.; Keystone Electrical Instrument Co., meters; Simonds Manufacturing Co., gears, pinions, etc.; National Electrical Manufacturing Co., electric heaters; Spiral Journal Bearing Co., motor and truck bearings; Clifton Manufacturing Co., tape and conduit; Munder Electrical Works, incandescent lamps; General Equipment Co., circuit-breakers; Speer Carbon Co., carbon brushes; J. E. Rhoads & Sons, car straps and cord; Eagle Iron Foundry, brake-shoes; Wheeler Reflector Co., electric headlights; Wagenhals Manufacturing Co., slow-feed controller handles; Reading Scale and Machine Works, castings of all kinds; Dale Co., lamp clusters; Van Dorn & Dutton Co., track cleaners; Morris, one-piece, drop-forged rail-bond.

The General Electric Company will present a number of devices and novelties. Its list of exhibits is not yet complete.

The Multiplex Reflector Company, of Cleveland, Ohio, will present a full line of its powerful reflectors.

The Lorain Steel Company, of Lorain, Ohio, and Johnstown, Pa., will exhibit samples of rails for street railway purposes, and of street railway special work in general. Also street car trucks and their electrical equipments.

The Consolidated Car-Heating Company, of Albany, N. Y., will have an extensive exhibit of its electric car heaters.

The Paige Iron Works, of Chicago, will have headquarters at the convention, but its most extensive exhibit will be its work distributed about the city of Chicago and within easy access of the convention.

The ELECTRICAL REVIEW will have convenient and commodious quarters, properly situated at the head of "Newspaper Row." Everybody is invited to call.

The Westinghouse Electric and Manufacturing Company will have extensive headquarters and will make a handsome exhibit of its latest manufactures and practice. Among its features will be the following:

One 500-kilowatt E. T. railway generator; one Standard railway switchboard for three generators, seven feeders and one load panel; one 200-kilowatt rotary converter; one complete railway equipment, consisting of two No. 68 motors, with controllers, diverters, fuse blocks, circuit-breakers, etc., to be mounted on a Peckham truck; one complete equipment, consisting of two No. 49 35-horse-power railway motors, with controllers, diverters, fuse blocks, circuit-breakers, etc., to be mounted on a McGuire truck; one No. 68 motor complete; one No. 70 motor complete; one No. 69 motor complete; one No. 56 motor complete, with pinion; one No. 56 armature complete; one No. 68 armature complete; one No. 69 armature complete; one No. 69 armature partially wound, with commutator partially connected; two K-10 controllers with one set of handles; one street railway diverter, taken apart; one canopy switch, style 5,793; two canopy circuit-breakers; two fuse boxes, 3,794; one tank lightning arrester; one choke coil, style 2,536; six 500 V-series arc lamps, with switch for circuit; three lightning arresters, style 6,799.

The J. G. Brill Company, of Philadelphia, will present handsome models representing the latest styles of street car trucks.

The Western Electrical Supply Company, of St. Louis, will make its headquarters with the Ohio Brass Company, which will have an extensive exhibit.

The H. W. Johns Manufacturing Company, of New York, and their Chicago representatives, the Manville Covering Company, of Chicago, will exhibit moulded mica overhead insulation, "Noark" indicating fuses, cars heaters, vulcabeston goods, asbestos pipe and coiled coverings and roofing. The exhibit will be in charge of Messrs. H. A. Reeves, T. F. Manville, T. G. Younglove and some six or seven gentlemen from the New York offices.

The Billings & Spencer Company, of Hartford, Ct., will have an extensive exhibit made through the firm of W. R. Garton & Company, of Chicago. It will include a line of drop-forged pure lake copper segments of standard street railway type, and also a line of overhead material. This exhibit will embrace the standard Billings & Spencer type of conical insulated stud, together with straight-line hanger, single and double curve pull-offs, etc. Another feature of the B. & S. material is the ratchet and pawl arrangement to prevent the loosening of caps. It is proposed also to exhibit the Kelsey noiseless ratchet brake which this company manufactures, and the patents on which it owns. The history of this noiseless rachet brake is said to be that wherever it has been used it has proved satisfactory in its working and has led to repeated orders—good evidence of its intrinsic worth.

The Jos. Dixon Crucible Company, of Jersey City, N. J., will show Dixon's graphited wood grease for lubricating the gears of trolley cars, and for preventing the noise which usually attends gears. They will also exhibit Dixon's pure flake lubricating graphite, Dixon's silica-graphite paint, Dixon's belt dressing and other products which are used by trolley companies. The exhibit will be in charge of Mr. A. L. Haasis.

Electrical Review

OLDEST ELECTRICAL WEEKLY IN THE UNITED STATES.

TIMES BUILDING, 41 PARK ROW,

P. O. BOX 2339. NEW YORK.

NEW YORK, OCTOBER 11, 1899.

CHARLES W. PRICE, - - - - - - EDITOR.
STEPHEN L. COLES, - - MANAGING EDITOR.
CHARLES T. CHILD, - - TECHNICAL EDITOR.
STEPHEN H. GODDARD, ADVERTISING MANAGER.

REGISTERED CABLE ADDRESS:
"ELECTVIEW," - - - NEW YORK.

TELEPHONE CALL, 1546 "CORTLANDT."

NEW YORK OFFICE:
RUSSELL HOWLAND, GENERAL REPRESENTATIVE,
Times Building, 41 Park Row.

WESTERN OFFICE:
FRANK E. COLBERT, REPRESENTATIVE,
935 Old Colony Building, Chicago.

WASHINGTON OFFICE:
GEO. C. MAYNARD, - REPRESENTATIVE,
Room 102, Washington Loan and Trust Building,
WASHINGTON, D. C.

LONDON OFFICE:
HENRY W. HALL, - - REPRESENTATIVE,
42 Old Broad Street, LONDON, E. C.
News, Subscriptions and Advertisements.

SPECIAL NOTICE TO ADVERTISERS.

CHANGES for advertisements must be in this office by Friday noon for the following week's issue
NEW ADVERTISEMENTS should be in the office not later than Saturday noon to insure publication the following week, although it is occasionally possible to get in matter received on Monday.

Subscription to the ELECTRICAL REVIEW.

One Year, United States and Canada, - - $3.00
One Year, Foreign Countries, - - 5.00
Single Copies, - - - - - - - - - .10
Copies can be supplied for only one year back, at 25 cents each.

CONTENTS.

Views, News and Interviews 225
Electric Illumination of the Government Building, Honolulu 225
A Direct-Current Power Transmission 225
Notes on Power-Station Economies.—I. 226
An Error in Mr. Lockwood's Paper 226
The Ohio Electric Light Association's Fifth Annual Meeting 226
An Ocean Telegraph Station 227
Seventy-Fifth Anniversary of the Franklin Institute 227
Science Brevities 228
Bequest To a Technical Institution 228
Street Railway Men Will Meet in Chicago Next Week 229
Progress in the Education of Street Railway Men 230
Electrical Equipment for the Manhattan Elevated Railways 231
An Electric Railroad in the Klondike 231
Wireless Telegraphy Patents 231
Wall Street and the Electrical Stock Market 231
Another New Jersey Electrical Combination 231
Personal 231
A $25,000,000 Electric Company 231
More Underground Conduit Railways in New York City 231
Suit on Alternating Wat meter Patent 231
Series Alternating-Current Arc Lamps 232
American Institute of Electrical Engineers 232
Series Arc Lighting from Constant-Current Transformers 232
A New Type of Electric Heater 233
British Electrical News 234
United States Army Electromobiles 235
Electrical Engineer in Electromobile Manufacture 235
Electric Railway from Easton, Pa., to Philadelphia 235
The Dynamo-Static Machine 236
Electric Light Flashes 236
Literary 236
A Generating Set With Horizontal Engine 237
An Electric Railway for Bordeaux, France 237
Western Electrical Trade News 237
Electric Motors on Board Ship 237
Automatic and Registered Telephone Service 238
Automobile News 238
Telephone News and Comment 238
The Automobile Magazine 238
Legal Note 239
Electrical Men at the International Yacht Races 239
Storage Battery Traction on the Erie Canal 239
Electric Railway Notes 239
Business Notes 239
Advance Information 240
Kindred Interests xvii
Electrical Patents xviii

Advertisers' Alphabetical and Classified Index on page xiv.

PROGRESS IN THE EDUCATION OF STREET RAILWAY MEN.

The American Street Railway Association, which meets next week at Chicago for its annual convention, has passed through a remarkable change in the quality and character of the discussions at its gatherings during the last twelve years. At about that period subjects such as the Proper Care of Harness, Methods of Ventilating Stables, The Nutritious Qualities of Bran Mash, etc., were principally talked about, while an occasional paper on Mechanical Traction, then limited to the cable, was read and discussed.

In two or three years the association was deep in the discussion of single trolley versus double trolley, of power houses, motors, dynamos, steam-engines and other such things that a decade past would have seemed as far from the legitimate sphere of its interests as subjects possibly could be. For perhaps five years, during the wonderful development period of the electric street railway, its electrical and engineering features formed the principal staple of discussion and comment at the meetings of the association. Interest in the meetings grew with the increasing interest of the subjects discussed at them, and a few years ago some of the most valuable papers on electro-technical subjects, allied with traction, that appeared anywhere, were presented before these conventions.

The art of building electric street railways having now reached that stage of completion and perfection where growth and improvement may reasonably be expected to be slow, and where the opportunities for revolutionary innovations are practically past, the managers of street railways naturally begin to turn their attention away from the minutiæ of electrical detail which have held it during the decade of development and are now looking toward the problems presented by the business management of their properties. Consequently at the forthcoming meeting there will be a programme which, for the first time in twelve years, contains no electrical paper. Discussion will be along the lines of the operative and financial management of street railways rather than having to do with their engineering features, whether of construction or operation. It may be said that the members of the association have graduated from the course of study in electricity and mechanics which they have pursued with diligence for a decade. This does not mean that there is any less interest in the engineering side of street railway work, but only that this industry having reached the steady condition of a finished art, its members no longer find novelty in the discussion of its engineering side, where the majority of them are adepts.

There has been strangely little effort to develop the suburban and inter-urban electric road as a freight railway. Of course it would be ridiculous to consider for a moment such roads as competitors of main line steam railways in the freight-carrying business, but there are certain sorts of merchandise which might be profitably handled. The average suburban road will carry 150 pounds of passenger six miles for five cents. It might get considerably more money by carrying much less weight of freights the same distance, and the freight business could probably be developed into a profitable auxiliary line in many cases. By limiting the sizes and weights of individual pieces of freight to what could be easily handled by the crew on the car, and by some stamp system of prepayment, obviating the necessity for freight agents, etc., the addition of a freight equipment would cost practically nothing except in the alteration of cars. It is certain that it would add practically nothing to the cost of operation. This subject ought to be discussed at length by those most interested at the forthcoming street railway convention, and it is to be hoped that some new ideas and the results of experience (where there has been any in this direction) will be brought out there.

The system of wireless telegraphy which was tried under Mr. Marconi's direction in the reporting of the international yacht races last week, appears to have worked very successfully and to have proved itself both satisfactory and practical for this purpose. If a rival newspaper had attempted also to send a similar report the result would not have been very satisfactory to either. So far as the public know, at least, there has not yet been devised a practical method of individualizing the signals sent by this system. It is as if one made a brilliant flash of light in the midst of great darkness, when every one who had an eye within the range of vision would see it. So with the wave signals which may be received by any number of stations other than the one for which they are intended.

Why should we adhere to the horrible misnomer "wireless telegraphy," which is in the same category as the expression "horseless carriage?" "Wave telegraphy" is an equally insufficient title because there may be so many kinds of waves. It is not yet in the least certain how the messages are transmitted; that is, whether the agency is Hertz waves, electro-static or electro-magnetic induction, or what not. "Etheric telegraph" is a vague and meaningless term, while "space telegraph" can only apply to the systems which can not be directed—soon, it is to be hoped, to be replaced by those that can be. What shall we call it? The ELECTRICAL REVIEW would like to receive some suggestions on the subject from its readers.

The state of the electrical industry in Great Britain is just now a subject of much legitimate interest to the American manufacturer or engineer. A study of conditions over there is always interesting and sometimes profitable. For this reason the ELECTRICAL REVIEW trusts that the British correspondence, begun in the last number, will be welcomed by its readers as well for its content of information as for its sprightliness of style. It is written by a gentleman having unusual opportunities of observation and sources of information and can be expected to give the latest and most accurate news of electrical happenings in the British Isles.

Electrical Equipment for the Manhattan Elevated Railways.

At Schenectady, N. Y., on Saturday last the General Electric Company received a visit from a number of officials of the Manhattan Railway Company, of New York. In the party were Messrs. Alfred Skitt, vice-president and general manager; George H. Pegram, chief engineer; W. E. Baker, general superintendent; L. B. Stillwell, consulting electrical engineer; A. F. Nagle, mechanical engineer, and H. Hazelton, assistant electrical engineer. It is said that the purpose of the visit to Schenectady was to ascertain the facilities of the General Electric Company for handling the large contracts involved in the equipment of the Manhattan elevated railroads in New York. The party also visited the transmission plant at Mechanicville, N. Y., and then went to Niagara Falls to view the electric power plant there.

It is stated that the same party will visit the plant of the Westinghouse Electric and Manufacturing Company at East Pittsburgh during the current week, with the same objects in view. Rumors in New York on Monday of this week were to the effect that the General Electric Company would receive the contract for the car equipments for the new electric system of the Manhattan Railway Company, and that the Westinghouse Electric and Manufacturing Company would receive the contract for the complete power-house equipment. At the present time, it is said, no one company in the United States could furnish the apparatus for both the power-house and rolling stock in the specified time. Hence it was believed the contract would be divided as stated above.

An Electric Railroad in the Klondike.

A press despatch from Tacoma, Wash., states that a survey is being made for an electric railroad from Dyea to Bennett over Chilkoot Pass. The project is being backed by Juneau men and the Upper Yukon transportation companies, which are opposed to the close traffic connections existing between the White Pass Railroad and the Canadian Development Company's steamboat line, both British concerns. The boring of a tunnel through the summit of Chilkoot Pass has been begun. It will be half a mile long. The thirty-one-mile electric line and tunnel will cost $750,000.

Mr. E. G. Bernard, of Troy, N.Y., visited New York city last week.

Wireless Telegraphy Patents.

Professor A. E. Dolbear, of Tufts College, Massachusetts, is stated, in a newspaper interview, to claim priority over Marconi in the use of the basic principles underlying inductive telegraphy. The accompanying illustration is taken from the specification of United States Patent No. 350,299, granted Professor Dolbear, October 5, 1886, and for which he had made application more than four years earlier. The language of the patent is very obscure in spots. It begins:

"My invention relates to establishing electric communication between two or more places without the use of a wire or other like conductor; and it consists in connecting the transmitting-instrument with a ground the potential of which is considerably above the normal, and the receiving-instrument with a ground the potential of which is considerably below the normal, the result being that an impulse from the transmitter sufficient to cause the receiver to give intelligible signals is transmitted through the earth without the need of any circuit, such as has heretofore been deemed essential."

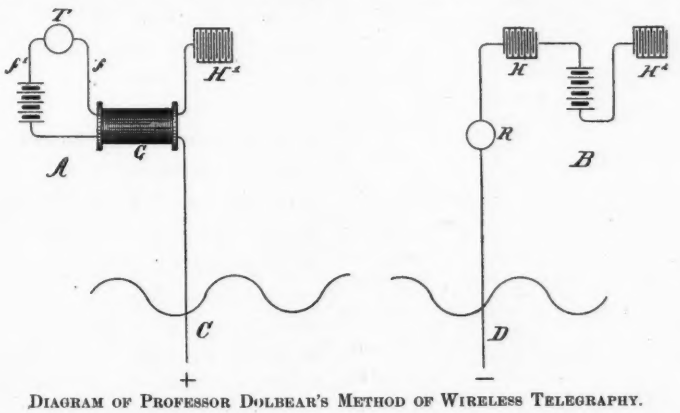


Diagram of Professor Dolbear's Method of Wireless Telegraphy.

The batteries at the sending end *A* and the receiving end *B*, keep the grounds "at a difference of potential," which is disturbed by a microphone at the sending end and picked up by a telephone at the receiving end. The claim of this patent is as follows:

"The art above described of communicating by electricity, consisting in first establishing a positive potential at one ground and a negative at another; secondly, varying the potential of one ground by means of transmitting apparatus, whereby the potential of the other ground is varied; and, lastly, operating receiving apparatus by the potential so varied, all substantially as described."

Wall Street and the Electrical Stock Market.

The early part of the week in the stock market was marked by an unsettled state of affairs, but since then prices have shown a tendency toward improvement. The state of affairs in South Africa will probably have an undesirable effect on the market until some certain development one way or the other occurs.

On the New York Stock Exchange General Electric closed the week at 118¾ bid and 119½ asked, a loss of 1 point for the week. Metropolitan Street Railway, of New York, closed at 197 bid and 197⅛ asked, a gain of ⅛ point for the week. Third Avenue Railroad, of New York, closed at 150 bid and 154 asked, a loss of 6 points for the week. Brooklyn Rapid Transit closed at 88⅛ bid and 88¼ asked, a loss of 2⅜ points for the week.

On the Boston exchange American Bell Telephone closed at 377 bid and 378 asked, a gain of 17 points for the week. Erie Telephone closed at 116 bid and 117 asked, a gain of 4 points for the week.

On the Philadelphia exchange Electric Storage Battery common closed at 124½ bid and 126 asked, a loss of 14 points in the asked price for the week. Union Traction closed at 39⅜ bid and 39½ asked, a gain of ½ point for the week.

On the curb or outside market in New York Electric Vehicle closed at 80 bid and no asked price, a loss of 5 points in the bid price for the week. Electric Boat closed at 18 bid and 22 asked, a gain of 1 point for the week.

Wall Street, October 7.

Another New Jersey Electrical Combination.

It is understood that the People's Electric Light and Power Company, of Newark, N. J., has acquired control of the Mountain Electric Company, of Summit, N. J.; the electric lighting company at Metuchen, N. J., and several other electric plants in the vicinity, which will be combined into one concern, with a proposed capital stock of $50,000,000. It is believed that Mr. David Young, the well known New Jersey electric railway man, is the moving spirit in the enterprise.

PERSONAL.

Mr. Beardsley N. Sperry, of Syracuse, N. Y., the well known electrical supply dealer, visited New York city last week.

Mr. Thomas A. Edison was the guest of Sir Thomas Lipton on his steam yacht Erin during the international yacht race last Thursday.

Mr. Clarence E. Stump, of New York city, who is widely known in the electrical field, has been appointed business manager of the *Christian Herald*.

Mr. A. C. Shaw, who is well known as an electrical newspaper man, will go to London early in November to open a branch office for the *Street Railway Journal*.

A $25,000,000 Electric Company.

The Philadelphia Electric Company was incorporated at Trenton, N. J., on October 6, with a capital stock of $25,000,000. The company is authorized to manufacture and supply gas, electricity, light, heat, steam, compressed and liquefied air, power, ice and cold storage. It is reported that the company will absorb the Pennsylvania Heat, Light and Power Company and the recently formed National Electric Company, and will ultimately control the electric lighting of Philadelphia. The Widener–Elkins syndicate is the controlling factor in the new concern.

More Underground Conduit Railways in New York City.

The Third Avenue Railroad Company, of New York city, now has in full operation its new underground conduit railway on One Hundred and Twenty-fifth street. Cars are running under one minute headway from the East River to the North River. A section of the Third Avenue line, from Sixty-fifth street north to the Harlem River, will be in operation in about ten days. The company has about decided to install a storage battery plant, estimated to cost $300,000.

Suit on Alternating Wattmeter Patent.

The Stanley Electrical Instrument Company, of Pittsfield, Mass., has brought suit against the General Electric Company for alleged infringement of its patent, Number 423,210, dated March 11, 1890, on alternating-current wattmeters. The Stanley company claims that this patent is fundamental and covers broadly induction wattmeters.

Series Alternating-Current Arc Lamps.

The successful operation of arc lamps in series on alternating current seems to be entirely assured, and has given to the alternating system the final element to enable it to compete in all particulars with the direct-current system.

The San Gabriel Electric Company, of Los Angeles, Cal., are putting in the largest plant of series alternating arcs yet installed, and will use 850 Manhattan lamps and nine regulators. The operation of the lamp is mechanical rather than electrical, the loss in the mechanism being claimed to be but five watts. The mechanism is of the concentric single solenoid type and contains no springs. The lamp carries an electrical cutout, thus affording protection to the mechanism. They can be placed upon circuits of any current from five to eight amperes without change of adjustment. The arc voltage is said to remain constant under all conditions. At 6.6 amperes and 72 volts at the arc, the total apparent watts at the terminal is 475; total true watts, 430. The true watts at the arc are 425, showing the loss to be five watts in the mechanism and the efficiency of the lamp to be .99. The power factor of the lamp is .91. In connection with these lamps the San Gabriel company will use nine regulating reactance coils of 25 per cent capacity; in other words, each coil will take care of the extinguishing of 25 per cent of the circuit. The regulator consists of a single, automatic, regulating reactance coil in series with the lamps.

A single coil is swung at one end of a lever arm, so that by moving vertically it will enclose more or less of one leg of an upright "U"-shaped core, the other leg acting to complete the magnetic circuit. At the opposite end of the lever arm is a weight which overbalances the weight of the coil, so that normally the coil is held outside of and above the core. When the circuit is completed to start the lamps, magnetic attraction causes the coil to be drawn down over the core. The action of the weight holds the coil in equilibrium when the desired current is flowing through the circuit. When lamps are switched off and the current tends to rise, the coil is drawn to further enclose the iron, the reactance effect increases, and the current is thus held constant. This regulation is claimed to be absolute to within one-tenth of an ampere, on any size regulator or at any load.

The loss in the regulator is, of course, constant, either at full or minimum load, being simply the C^2R loss in the coil, plus a very slight iron loss. Regulation is said to be perfect to within one-tenth of an ampere from maximum to minimum load.

The capacity of the regulator, the insulation, etc., need only be in proportion to the number of lamps to be extinguished. This gives a very simple and compact device. It will be seen that, where the regulator is to take care of but 10 per cent of the load of the circuit, it requires an insulation against only 10 per cent of the total electro-motive force of the circuit, so that a large number of lamps, with very high voltage, can be handled with safety. The loss in these coils is said to be but 200 watts at any load, and as there will be nine coils employed in this installation, the loss in the regulators will be 1,800 watts. The power factor of the circuit, including lamps and regulators, is .89 to .90. The lamps will run 100 in series on a 7,500-volt primary circuit. The Manhattan General Construction Company, of Newark, New Jersey, furnished the apparatus for this installation.

American Institute of Electrical Engineers.

The first regular meeting of the season was held at 12 West Thirty-first street, Wednesday, September 27, President Kennelly in the chair. The paper of the evening, presented by Prof. W. Lispenard Robb, of Hartford, Conn., was on "Series Arc Lighting From Constant-Current Transformers," and a working model of the apparatus was shown which was heartily appreciated by the audience. The discussion was participated in by Messrs. Fleming, Steinmetz, Hallberg and Mailloux. At the meeting of council in the afternoon the following associate members were elected:—Henry Arthur Campbell, electrician, Jamaica Electric Light and Power Company, Limited, 38 Harbor street, Kingston, Jamaica; Leslie Foster Davis, secretary and manager, Jamaica Electric Light and Power Company, Limited, 38 Harbor street, Kingston, Jamaica.

The following associate members were transferred to membership:—William Enoch Moore, general superintendent and electrician, the Augusta Railway and Electric Company, Augusta, Ga.; Henry M. Hobart, engineer, care British Thomson-Houston Company, London, England; G. Sacco Albanese, electrical engineer, Tramways Electrique de Nice, Nice, France.

In order to satisfy the increasing demand for the final report of the Committee on Standardization, the secretary was authorized to publish a special edition which will be sold at a nominal price. All members of the Institute have already been supplied with copies in the regular edition of the Transactions.

SERIES ARC LIGHTING FROM CONSTANT-CURRENT TRANSFORMERS.

READ BEFORE THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, NEW YORK, SEPTEMBER 27, 1899, BY PROFESSOR WM. LISPENARD ROBB.

In all long-distance transmissions of electricity, and when large areas are supplied from a single advantageously located power plant, we must, at least in the present state of the art, generate and transmit alternating current.

In general it will be found desirable, in my opinion, to supply current to the street lights from the same secondary mains that supply the current for the commercial lighting and power. There are, however, in most places large districts in which the streets are lighted by arc lamps, and where there is no commercial lighting or power. These sections can be most economically lighted by series arc lights.

Various methods of operating series arc lamps from alternating-current systems have been suggested, and are in successful operation.

In several well known stations in this country, continuous-current series arc dynamos are driven by synchronous or induction alternating-current motors, the arc dynamos being either direct-connected to motors or belted from a line shaft which is driven by motors. In England, direct-current series arc lamps are operated successfully from rectifiers. In 1896 the Hartford Electric Light Company, with which I am associated, decided that it would be advantageous to make a radical change in its system of series arc lighting, with a view to obtaining a greater economy of operation. The series commercial arc lamps and the street lamps in the same section of the city were changed over from series open-air arc to constant-potential arcs. It was considered advisable to continue the series arc lamps for lighting the outlying portions of the city. Propositions were considered both for using motor-driven series arc dynamos and for using rectifiers.

An order was finally placed with a manufacturer for a rectifier. A satisfactory rectifier never materialized, and we were unsuccessful in our attempts to import one from Europe.

The development of the enclosed arc lamp quickly led to the evolution of a satisfactory alternating-current arc lamp of the constant-potential variety. The perfection of this lamp led Mr. Richard Fleming, one of the engineers of the manufacturing company, to suggest the advisability of operating series alternating arc lamps from the constant-current transformer, which formed one of the essential parts of the rectifier.

An experimental transformer, having a capacity for operating 30 lights in series, was installed in April, 1898. After being subjected to a thorough test in the central station it was put in practical operation on a street circuit. The results of these tests were so satisfactory that an order was soon placed for several transformers, each having a 100-light capacity. The first of these transformers was installed about a year ago, and during the year all of the continuous-current series arc dynamos have been replaced by constant-current transformers.

It has seemed to me that it would be of value to some of the members of the Institute if the data obtained in the operation of the transformers were made a matter of record in the proceedings.

Each transformer is enclosed in a cylindrical tank. The tanks were originally made of boiler iron riveted up, but it proved impossible to keep these tight against the transil oil in which the transformer is immersed. The tanks are now made of cast-iron.

The core of the transformer is of the sheet type, with a large central vertical core rising the whole height of the tank. This central core is surrounded by the primary and secondary coils, and the magnetic circuit is closed by return paths outside the coils. In the transformers, as made by the General Electric Company, there are two primary and two secondary coils. One of the primaries is fixed at the bottom, and the other at the top, of the central core. The two secondaries are free to move up and down between the primary coils, and are so connected together that when one falls the other rises. They may approach into contact with each other at the middle of the tank, or from this position one may rise toward the primary coil at the top while the other falls towards the primary coil at the bottom. Connected with the chains by which they are balanced is a lever which extends outwardly from the top of the oil tank and carries, depending from its outer end, a heavy adjustable weight. The lever is supported on a hardened steel knife-edge. This weight tends to force the two secondary coils respectively toward the two primary coils. When the transformer is in operation the currents induced in the secondary react upon those in the primary and tend to force the coils apart. This force is balanced for the desired normal current by the adjustable weight outside of the case. If the resistance of the secondary circuit falls, due to the cutting out of lamps, the current increases slightly, increasing

the repulsion effect, and the secondary is pushed further away from the primary, giving a chance for increased magnetic leakage between the primary and the secondary, which reduces the electro-motive force in the secondary, bringing the current down to practically normal, even with wide changes of resistance. The regulation obtained is adjustable by means of a cam-shaped segment which can be moved on the outer end of the weighted lever.

The principle of regulation was first suggested by Professor Elihu Thomson, and its application to the operation of constant-current transformers is broadly patented by him.

By bringing out the proper connections from the secondaries the total number of lights may be operated as a single circuit or operated in any desired number of multi-circuits in a manner similar to the well known method employed on the Brush series dynamos of large capacity.

The larger sizes of this type of constant-current transformers are always so arranged that the lights can be run on two circuits, or a single circuit, as may be desired. Owing to the high voltage of the enclosed arc lamp, the 100-light transformers usually operate two circuits connected upon the multi-circuit principle.

The transformer can be adjusted so as to give practically a constant current between one-third load and full load. As the properties of the transformer make it undesirable to run the transformer at less than one-third load, no attempt has been made to so construct the transformer that it would regulate under smaller loads. By adjusting the cam-shaped segment from which the counter-balancing weights are suspended, it is possible to regulate the transformer so that the current will increase or decrease as the number of lights is varied. The curves shown in Fig. 1 show the range of regulation that can be obtained by varying the adjustment of the cam supporting the regulating weights.

The early tests showed that when the transformers were adjusted to give a constant current through any desired range of load that the lamps would draw different lengths on the arcs depending on the number of lamps on the circuit. The voltage across the terminals of the individual lamps was approximately 10 volts higher at one-fourth load than at full load, although the current was the same in both cases. The results of a test of a 100-light transformer made to show this effect is shown in Fig. 2. It has been found, however, that by varying the adjustment of the transformer it is possible to adjust it so that the voltage across the terminals of the individual lamps remains practically constant at various loads. If so adjusted, however, the current from the transformer is no longer constant but increases as the load increases. The adjustment that maintains a constant voltage across the terminals of the individual lamps seems the preferable one in those cases where the load of the transformer varies through a wide range. It is, however, of little practical importance in the operation of a street-lighting circuit, as in that case the transformers are seldom operated in actual practice at less than 90 per cent of full load.

Tests were made of the efficiency power factor and temperature rise of the transformers. The input and output of the transformers were measured with Weston wattmeters, ammeters and voltmeters, and were calibrated before and after test with standard laboratory instruments.

The averages of the results obtained from two 100-light transformers were as follows:

Load.	Efficiency.	Power Factor.
⅓ Load.....	88.1	24%
½ "	92.3	44%
¾ "	94 9	62%
Full "	96.1	78%

The rise in temperature of the oil

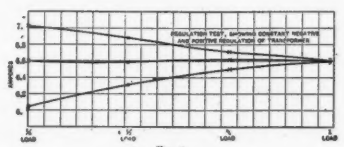


Fig. 1.

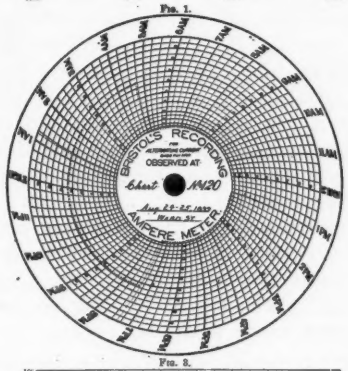


Fig. 2.

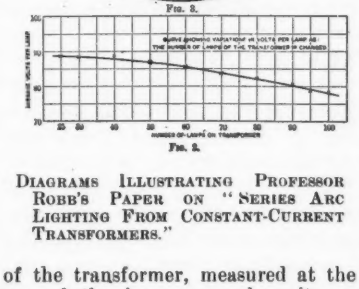


Fig. 3.

DIAGRAMS ILLUSTRATING PROFESSOR ROBB'S PAPER ON "SERIES ARC LIGHTING FROM CONSTANT-CURRENT TRANSFORMERS."

of the transformer, measured at the top of the iron core, where it was highest, was 39 degrees centigrade after a twenty-four hours' run.

Under the usual conditions of street lighting, the dynamos are run under at least 90 per cent of full load, and at this load the efficiency and power factor are very satisfactory. The power factor is about as high as that of the induction motor under the average load at which they are operated.

The low-power factor at fractional loads, and the difficulty in maintaining the lamps at constant voltage when the current is constant at various loads combine to make the constant-current transformer undesirable except when the conditions are such that it is possible to operate the transformer under a large part of its rated full load.

It has been found in practice that the transformers can be maintained and operated successfully with very little attention. In Hartford five of the transformers are operated from two outlying substations. There is no attendant at either of the stations. The inspector of the district cuts on and off the lights at the proper time and visits the substations once during the night. Each transformer is equipped with a recording Bristol ammeter so that a complete record is made of the time of cutting on and off the circuits and of the time the inspector makes his nightly inspection, and of the working and adjustment of the transformer. A record selected as being a fair representation of the daily records is given in Fig. 3. The primaries of the transformers are connected across the 2,400-volt alternating-current feeders. Although the voltage at the terminals of the primary of the transformer is subject to a variation of 5 per cent during the street-lighting hours, the current supplied to the series lighting circuits is practically constant. The transformer whose operation is recorded in Fig. 3, takes its current from the alternating-current lighting system about one mile from the central station. The current in the secondary is not affected by variations in the pressure at which current is supplied to the primary of the transformer.

The lamps operated from the constant-current transformer are of the carbon-feed enclosed type. The alternating current used has a frequency of 60 cycles. The operation of the lamp is on the differential principle.

The lamps at the outset gave a good deal of trouble. A considerable percentage of the lamps failed to start. This trouble was soon found to be due to the burning out of the sliding contact by which electric connection is made with the upper carbon. A positive contact is now made by means of a very flexible wire made of fine strands. Since this change the operation of the lamps has been in all respects satisfactory. The records show that the lamps reported out and not starting are considerably less than they were when the street lighting was by direct current series open-air arc lamps.

Unfortunately I have been unable up to the present to make any photometer tests of the candle-power of the series alternating arc lamps. The lamps used in Hartford consume at the transformer 400 watts per lamp, and replaced nominal 1,200 candle-power open-air direct-current arcs. The streets are undoubtedly better lighted with series enclosed arc lamps than they were formerly with the open-air arcs. The better diffusion of the light from the enclosed arc lamp, the steadiness of the light and its freedom from flickering, have much to do with the improvement in lighting and with the general satisfaction it undoubtedly gives. From the results obtained at Hartford I am confident the streets can be better lighted with 400-watt series alternating lights, than with an equal number of nominal 1,200 candle-power open-air direct-current arcs. If 2,000 candle-power direct-current arcs were replaced by enclosed series alternating it would, in all probability, be necessary to increase the number of lamps in order to obtain equally good lighting.

Before the changes in the street-lighting system the lamps were operated from Excelsior, Thomson-Houston and Brush series dynamos, belted from the line shaft. This was driven by a direct-connected synchronous motor. The power furnished the synchronous motor was 550 watts for each open-air arc lamp consuming 315 watts at the lamp. The power required under the local Hartford conditions for operating street lights has therefore been reduced by the change in the ratio of 550 to 400, or a little over 27 per cent.

Owing to the fact that the transformers are operated from outlying substations, the wiring system has been very much simplified, and the cost of carrying current across the underground district considerably reduced. The maintenance of the transformers and the labor in looking after their operation is an almost negligible item. A very considerable saving is made over the maintenance and operation of the series direct-current dynamo. From experience extending now over a year it has become evident that the saving in operating expenses will pay for the entire cost of the change in system within the first two years. At the expiration of this time there will be a very considerable annual saving, and at the same time the service rendered the city is very much better than it was under the old system.

The system of street lighting which will be found best for any given city depends largely upon the local conditions, but there are undoubtedly many cases where an investigation will show that the adoption of the constant-current transformer and the series alternating-current arc lamp offers the greatest advantages.

A New Type of Electric Heater.

A patent has been granted to Mr. M. W. Dewey, of Syracuse, N. Y., for a simple variety of electric heater, belonging to the class in which air is permitted to circulate over the hot wires. The construction of the heater is extremely simple and durable, and it occupies little space and can easily be taken apart and repaired. It is formed of a pair of oblong plates having grooves or corrugations therein. The inner sides of the grooves or corrugations are covered with porcelain or other suitable insulating enamel. Coils, forming the electric heater conductor, lie in the grooves between the plates, and the plates are secured together by short bolts or screws. In some cases the plates are perforated and held separated sufficiently to permit the air to circulate between them and through the coils.

BRITISH ELECTRICAL NEWS.

[*From our special correspondent.*]

The week has not, from an electrical point of view, been specially eventful. The trade, as a whole, is as busily occupied as it well can be; to judge from the columns of the electrical press there are more vacancies for qualified electricians than there are men to fill them; orders are being booked as much as two years ahead; and it is probable that if your countrymen carry out their threat—indeed, it would be better described as their intention—to set up some big works upon the lines of those which have been so successful on your side of the Atlantic, upon English ground, there seems no reason why they should not find plenty of work to do, and that without unduly encroaching upon the interests of native firms. For indeed it is beginning to be widely realized that we English folk have been dozing, not to say asleep, in matters electrical these many years past; and now that the boom is upon us, and an awakened public demands light railways and electric lighting everywhere, we have been caught unprepared, and are literally unequal to satisfying the requirements of the public aforesaid. Of course the electricians are not wholly, or even principally, to blame. The public itself has been as obstinately conservative as it well could be. Even now the city of London will not hear of a tramway within its ancient borders; and the London County Council, which controls the surrounding region, is showing no undue haste or enthusiasm in the matter of introducing electric traction, though it professes to have undertaken the task with joy. With public bodies, as with individual men, there is considerable divergence between profession and action, and the rule of the so-called Progressive party in the Council is generally one long record of disappointment and neglected pledges. The tramway officials, who came under the rule of the council with such bright anticipations, are finding out that the little finger of the friends of humanity is thicker than the loins of the old companies, and they have been expressing themselves freely to that effect in Hyde Park and elsewhere, somewhat to the discomfort of Mr. John Burns and his following. Another factor in the hitherto universal apathy of the public, in regard to matters electrical, has been the widespread mendacity of the gas managers, who spread the funniest kind of stories about the cost and quality of electric light, and get a hearing as being upon the spot. It matters not that the facts have been authoritatively ascertained by the most exact photometric experiments; the gas manager is of the seed of Ananias, and must lie to live. I have been told that an absence of conscience has been observable among the gas managers over your side, but there is a wider surface in your country for utterances of this kind to evaporate from. We, you will understand, are more cramped for room. Sometimes it seems as though a real good epidemic of falsehood, such as that which has recently devastated France, culminating in the Dreyfus trial, might absorb a little of our surplus mendacity, but my daily inspection of press cuttings proves the fact to be otherwise. The gas manager is like Paget, M. P.—"a liar, and a fluent liar therewith."

The meeting of the British Association has been wound up with due *éclat*, and the results, as a whole, are regarded as most successful. On Saturday the French scientists paid a visit to their English *confrères* at Dover, and on Thursday a party of English scientists returned the visit at Boulogne. Both events passed off well. Sir William Preece, the late eminent engineer to the Post Office, has been presented with the freedom of his native city, Carnarvon, which was made the occasion of an imposing function. Sir William's name will be familiar to you from his past achievements, and it is probable that it will become even more so in the not far-distant future, when the experiments which he is conducting in etheric telegraphy have been carried further into effect. The results obtained so far have been most encouraging, and are expected to eclipse in no long time those achieved by Marconi. Sir William's aim is to transmit sounds—and he has already succeeded in transmitting a series of taps—which can be utilized for sending messages by the Morse code. So far, it is claimed that the system yields much more rapid results than Marconi's, though it is admitted that something more is necessary to bring it into perfection. That something, I have no doubt, Sir William will not be long in evolving.

The Institution of Electrical Engineers is to be represented at the Volta celebrations at Como by Professor Silvanus Thompson and Professor W. E. Ayrton, both excellent men. It was Mrs. Ayrton, as you may remember, who made such a stir not long since by her researches and discoveries in connection with the hissing of the electric arc.

It has been decided to depute a Board of Trade official to inquire into the conduct of the Dublin tramcars, which, in the pride of their electric motive power, has been altogether too exuberant for the sober requirements of practical life, though the fault, to my mind, has not been entirely their own. The fact is that a few days since a skittish young car caught sight of the Lord Mayor's carriage standing, doing no harm, it is true, but looking much more dignified than any mere vehicle has any right to look in these democratic days, with a very dignified coachman, indeed, upon the box, and the car, feeling (as you would say) "right good," butted it full, and, to use an expressive vulgarism, "knocked it silly" and upset the coachman. His Lordship the Mayor came out, and with admirable readiness directed that the injured man should be sent to the hospital; and then, I presume, freed his mind to the Powers That Be, and made representations in the Proper Quarters (mind these capitals please, for it is a dangerous thing to speak evil of dignities in this effete old country), and now that unfortunate young tramcar and the parties responsible for his proper control are to be taken to task. I must confess that my sympathies are with the tramcar. In my youth I was brought up at a school where the Lord Mayor of London was wont to attend once a year in state to distribute the prizes to the least depraved among us. The passages leading to the lecture theater would be crowded with powdered footmen, enormous as to the calves, and we boys used to make experiments—as furtive as circumstances permitted—upon those calves with pins from adjoining class-room doors, fleeing precipitately when a bad "cuss word" told us that the last calf pierced was real and not sawdust. So that you will easily realize that I am not a respecter of Lord Mayors and their following, and that is why I should like to get this misguided young tramcar out of its scrape, if I could; for I feel quite certain that if I had been a tramcar I should have done the same thing myself. Unfortunately, however, the tramcars have other matters to their charge. A few nights ago the peaceable Dublin folk were seriously fluttered by shouts of "Fire!" and a general stoppage of tramcars, followed by a stampede of excited passengers, fleeing from they knew not what. It is not quite clear what did happen, but somehow a trolley-pole and a gas-pipe attached to it fell out, and the gas-pipe being Irish, and, therefore, plucky, up and exploded and spat flame and interrupted the flow of current along the wires, so that the whole tramway service of the city came to an abrupt standstill. The original offender will never, perhaps, be certainly known; but the great British Public—or, in this case, the Irish Public—has firmly made up its mind that electricity and the tramcars are responsible, and will continue to hold that view, whatever the inquiry may disclose. The tramcars are, it must also be admitted, just a trifle hot-tempered. A Brixton Cockney, I think it was, pulled a rope on board of a tramcar which was no concern of his, and the severity of the punishment that he received from the injured vehicle created a decidedly bad impression, even after all allowances had been made for the exasperating manners of a Cockney tourist. I ought to have mentioned, too, that during the last few days, another excitable tramcar had a disagreement with a haycart, which failed to move out of its way quickly enough. "In the scene that ensued" the haycart got very much the worst of it, though the tramcar did not escape scatheless. So that although I myself am inclined to sympathize with the suffering tramcars, I fear that they have aroused some not unnatural prejudices, and that they have a warm time awaiting them before a Board of Trade Inspector, with no humor and bowels of tape. Next week, perhaps, I may be able to tell you how they have fared.

The full text of the minute in which the Glasgow University takes leave of Lord Kelvin has been published, and is such as to reflect the highest credit upon that body. It alludes to his great services in the "beneficent application of the inventions of science to the wants of life, to the lightening of labour, to the comfort of the dwelling, to the safety of the traveller by land and sea, to the promotion of the facilities of commerce and the means of human intercourse." It recalls with pride his great scientific achievements, "the kindness of his heart, the uprightness of his character, and the honourable simplicity of his life." Lord Kelvin has applied for an appointment as a Research Fellow of the University, and there is no doubt that the authorities will be proud to enroll him among that body.

London, September 30, 1899.

United States Army Electromobiles.

For the first time in the history of the United States Government a contract has actually been placed and executed by the Woods Motor Vehicle Company, of Chicago, Ill., for electromobiles, consisting of three in number, designed for the Signal Corps of the United States Army expressly under the specifications of the chief signal officer.

FIG. 1.—ELECTROMOBILE FOR TRANSPORTING OFFICERS OF THE UNITED STATES ARMY SIGNAL CORPS.

Two wagons are made on the design shown in Figure 2, and are designed to carry the signal corps' various instruments and paraphernalia; one wagon, illustrated in Figure 1, is designed for the officers of the signal corps to ride in.

The equipment of the first mentioned wagons consists of 40 cells of storage battery of sufficient capacity to run these vehicles 30 miles on one charge of the batteries when carrying 1,500 pounds transportation load. The motor equipment consists of two 3½-horse-power motors, one attached directly and independently to either rear wheel, and so wound and designed that they can be worked on grades and bad roads to as high as 6 horse-power each, which would mean a maximum power capacity of 12 horse-power for each wagon, with batteries of sufficient size to work at that point for emergencies.

The maximum speed of the vehicles is 10 miles per hour. Among the novel features is the entire absence of anything like bicycle construction or what is commonly expected in automobile construction. Every piece of ironwork in the vehicle was hand forged in the smith shops of the makers. The wheels were especially desiged and made with steel hubs, the inside of which forms receptacles for the ball bearings, as it was found that iron hubs were not adequate to this work. In lieu of pneumatic tires solid hard rubber tires 2½ inches in diameter have been used, as army service can not afford to take any chances of punctured tires or breakdowns from any such cause.

While outwardly similar in appearance to delivery wagons, the interiors of these vehicles are constructed after army specifications and are accessible from both rear and front; they are supplied with doors which, when the wagons are not in use, lock everything securely on the interior.

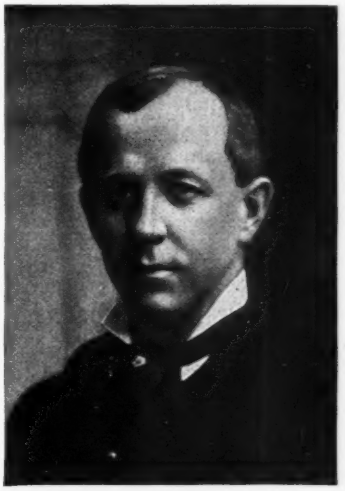
Another very noticeable feature of these vehicles is their painting. They are finished in olive green, in both body and gear, without any form of ornament or striping, being painted as near the color of grass and foliage as possible, so that they will not be conspicuous to an enemy in the field. They are fitted up with electric lights in the side lanterns and in the larger vehicles in the interior also, and it is understood that a new form of searchlight will be added later to the equipment of these wagons for use as occasion may require.

The city of Winnipeg has adopted the Western Electric system of arc lighting, and has now installed a complete plant for street lighting under municipal control.

Electrical Engineer in Automobile Manufacture.

Mr. C. E. Woods, whose portrait appears on this page, is an electrical and mechanical engineer who has made himself widely known in connection with electromobile manufacture, as developed in what is known as the Woods motor vehicles. For many years prior to his taking up the question of self-propelled vehicles, Mr. Woods was known as an electrical engineer, and produced many lines of dynamo-electric machinery for various companies. He became interested in the self-propelled vehicle proposition from the fact that his father was a carriage manufacturer, and decided at the outset that a successful issue in automobiles would require a general line of carriages in their many styles. He therefore spent some two and one-half years in developing his electrical system of propulsion before soliciting any great amount of capital or market.

The confidence that the gentlemen associated with Mr. Woods in his company have in him, is evinced by their making him general manager of all of the large interests now possessed by the Woods Motor Vehicle Company. Mr. Woods personally takes charge of all of the designing of a mechanical and electrical nature in addition to the company's business, and designs personally the many different forms of carriages which his company are now placing on the market.



MR. C. E. WOODS.

Electric Railway from Easton, Pa., to Philadelphia.

The ELECTRICAL REVIEW learns that the Easton & Nazareth (Pa.) Electric Railway Company has let contracts for the material required to build twenty-four miles of road between the two towns named. This road, when completed, will finish the connecting link in a continuous line of electric railways between Easton, Pa., and Philadelphia, a distance of about fifty miles. It is understood that the road will be in operation some time during the Winter.

FIG. 2.—ELECTROMOBILE FOR TRANSPORTING UNITED STATES ARMY SIGNAL CORPS MEN AND PARAPHERNALIA.

THE DYNAMO-STATIC MACHINE.*

BY PROFESSOR ELIHU THOMSON.

That brilliant physicist Planté, whose name is so well known in connection with the early Planté cell or accumulator, invented what he called a rheostatic machine, consisting, in substance, of a set of condensers charged in multiple (as from a great number of battery cells connected in series and giving, say, 5,000 volts) with commutating or switching apparatus for connecting the condenser plates in series or in cascade, thus reducing the capacity of the series set and raising the terminal potential in proportion. If ten such condensers were used in the apparatus, and the charging potential were 5,000 volts, then the series connection would yield discharges of approximately 50,000 volts.

Professor Trowbridge, of Harvard, has in recent years greatly magnified the effects of the Planté machine. He has arranged small storage cells to be charged in sets or in multiple by a dynamo, and then connected in series so as to give 20,000 volts or more of continuous potential at the terminals. With this battery of relatively high potential he charges in multiple a range of condensers consisting of glass plates coated on the two sides with tinfoil, except near the edges. By a large shifting frame worked by a lever he throws the connection of the condensers, after charging, into series order or cascade. The end condenser foils of the set are connected with the discharge terminals of the apparatus. In this way he obtains with great ease discharges of three or four feet in length, and of great brilliancy and beauty, one spark at each throw of the commutator lever. With a large machine of this type he has obtained sparks of seven feet in length, the distance covered being in fact limited by too close proximity of the walls of the building, its floor, its roof, etc., and not by the real capability of the apparatus, which, without the leakages and lateral discharges, would be capable of producing potential differences of 3,000,000 volts.

It was while studying the action of Professor Trowbridge's apparatus that it occurred to me to dispense with the large series of battery cells used in charging, and employ instead thereof the tops of the waves of a high-potential alternating current suitably delivered in one direction. I was thus enabled to produce a new machine for obtaining high-potential discharges. It consists partly of a motor-dynamo, such as is obtained by taking an ordinary continuous-current motor and tapping the winding, so as to obtain alternating currents. To this end two of the commutator segments or leads are connected to a pair of insulated metal rings on the shaft. Brushes resting on these rings yield alternating currents of a periodicity depending upon the speed and number of field poles. This machine may be driven by continuous current, or as a synchronous alternating-current motor after starting, or it may be driven by mechanical power as a self-exciting alternating-current dynamo. The alternating-current brushes are connected to the terminals of the primary winding of a step-up transformer, giving in the secondary a potential of, say, 10,000 to 15,000 volts. Driven by the shaft of the machine is a frame of insulating material, such as wood, having at one side a pair of metal strips which periodically connect the high-potential secondary terminals of the step-up transformer to the plus and minus foils of a set of condensers (eleven glass plates coated with tinfoil) in parallel. These connections, to avoid noise and friction, are made without actual contact; that is, over a small spark gap. The revolving frame is so adjusted that the charging shall be completed only at the tops of the waves, and thus a high potential be available for charge. Moreover, in the particular machine before you the tops of only every third alternating wave of the same polarity are employed, and thus the condenser plates or foils are always given the same polarity. In this way the chopped-up alternating discharge becomes, for charging the condensers, a substitute for a high-potential battery. The revolving frame carrying the charging strips also carries a set of series connectors, whereby, after the charging strips have withdrawn from proximity to the stationary contacts led from the condenser foils, these contacts are connected in series, as in the Planté or Trowbridge machines, and the terminals or end foils discharge across a wide air gap at high potentials, giving a rapid series of sparks of about twelve inches in length in the apparatus here shown. The length of spark is governed by the number of condenser plates and the potential of the charging current. This may be made to correspond with the maximum potential of the wave in the secondary of the high-potential or step-up transformer. I find shellacked wood sufficiently insulating for the parts of the machine outside of the condensers and metal connections.

The machine has been further developed and improved by me until it actually becomes a practical substitute for a static machine, independent of the weather. It, therefore, needs no outer case nor means for drying. I have added a simple attachment whereby Leyden jar batteries may be charged or a stream of thin sparks obtained, and with this attachment the machine may be used to excite the sectors of large influence machines, if desired, in all states of the weather.

This attachment consists of a revolving connector covering a wide gap between one of the terminals or end condenser foils and a stationary insulating ball or conductor. This connector itself, consisting of a pair of balls or rounded surfaces connected by a wire, is insulated and synchronously bridges the gap of several inches between the end condenser terminal and the insulated ball. The time of making this connection coincides with the series connection made by the revolving frame. The insulated ball or conductor thus is synchronously charged, while the opposite terminal of the apparatus may be put to earth. The ball may be made either positive or negative by changing the alternating-current connections from the collector rings to the primary of the step-up transformer or in other ways. A Leyden jar battery or condenser may be charged by connecting its interior coating with the insulated ball and its exterior to earth, or to the opposite terminal of the apparatus, and from the charged jar condenser a string, dipped in very weak acid or rubbed in graphite, may be made the means for conveying the jar charge slowly to a prime conductor for weak or thin sparks, whereby the effects of a static machine may be closely reproduced.

The whole apparatus combines so many features of transformation of energy as to become a highly instructive apparatus for schools, and its capabilities are quite varied, as can be readily understood. I call it my dynamo-static machine.

I may mention as an interesting fact that the new machine may be used to charge a set of condensers to a high potential in a second rheostatic machine, after which series connections being made, as in Professor Trowbridge's apparatus, a second multiplication of potentials would result. Very high potentials may thus be obtained.

* Extracted from a lecture before the New York Electrical Society.

ELECTRIC LIGHT FLASHES.

At Lehi City, Utah, $40,000 in bonds have been voted to build an electric light plant.

An election will be held November 14 to vote on the question of issuing bonds for a light and water system at Hillsboro, N. D.

The Board of Aldermen of Waterville, Me., have granted franchise to the Union Electric Gas Light Company to construct an electric plant.

An election will be held at Albion, Mich., to vote on the question of issuing $150,000 in bonds, to establish an electric light plant in connection with the waterworks.

Thompson S. Grant, comptroller, is in favor of putting in an electric plant in the Capitol Building at Hartford, Ct. The estimated cost of the plant and wiring is $25,000.

A saw-mill at Rock Island, Ill., will soon pass from the management of the Rock Island Sash and Door Company to the Rock Island Lumber Company. The plant will be overhauled and equipped with an electric light plant.

The Board of Public Works have signed the contract for the purchase of the Monroe, Mich., electric light plant. The old company, which has for nine years lighted the city, will replace the machinery now in use with modern generators and put in new enclosed lamps.

LITERARY.

The largest issue of *Harper's Weekly* ever published is the Dewey Memorial Number of September 28. For interesting and authoritative articles and fine drawings this Dewey number is remarkable. Rudyard Kipling contributes a poem, his most striking work since his illness, appropriately entitled "Let Us Now Praise Famous Men." A history of the Dewey family and a sketch of the Admiral's life is contributed by the Hon. John Barrett, late United States Minister to Siam. The number contains also an important article on the United States Navy, by Henry Loomis Nelson, and special articles on Dewey and the Manila campaign, illustrated with many hitherto unpublished portraits and with superb drawings of naval scenes. The issue for October 7 will describe Admiral Dewey's reception in New York, and the succeeding number will be given over to the story of the contest for the America's cup.

A Generating Set with Horizontal Engine.

The center crank type of horizontal engine has become much more popular since the advent of the type of generating set, of which it so readily forms a component part. The form of set illustrated herewith is one of several types, designed and manufactured by the B. F. Sturtevant Company, of Boston, Mass.

The engine was primarily designed for dynamo driving, and, in every particular attention was given to those features necessary to successful operation under such conditions. The engine and generator rest upon a common cast-iron bed. The engine itself is of such design as to partially enclose the running parts. The oil guard and the removable side plates serve still further to render it of the enclosed type, and to this extent prevent the entrance of dust and the throwing of oil.

The valve, which is of the balanced piston type, is provided with snap rings, and operates in a removable bushing, thereby making it a simple matter always to keep it tight.

The regulator, which is claimed to be capable of the closest possible regulation, operates through a range of zero to three-quarters cut-off. The engine cylinder is thoroughly lagged. All moving parts are adjustable, and continuous sight-feed oiling arrangements are provided throughout. The armature is mounted on an extension of the engine shaft, which is supported at its outer end by an independent pedestal with ring oiler.

This generator is of the multipolar type, the field ring and cores being of cast-steel, and the pole-shoes of cast-iron. The proportioning of the magnetic field and armature is such as to insure sparkless operation under all changes of load, from no load to 25 per cent overload. The temperature rise after a full-load run of 10 hours is limited to 90 degrees Fahrenheit. The armature is of the barrel-wound type. A cast-iron flange, bolted to the armature spider at each end of the core, forms a support as well as a cylindrical receptacle for the projecting ends of the coils. The flange extension also protects the windings from any oil that may be thrown. The surface of the interior of this flange is perfectly smooth, offering no opportunity for the collection of oil or dust.

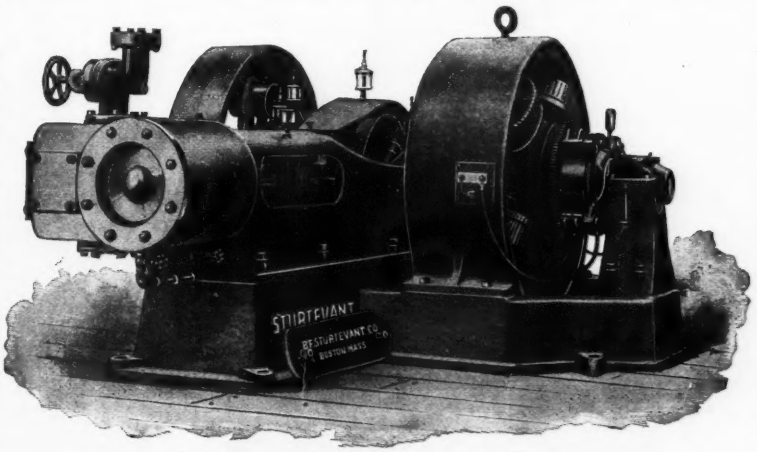
Ventilation is effected by the use of specially constructed vanes, forming ducts between the laminae of the core. These convert the armature into a blower, and create a strong draft through the windings.

The series winding of the field coils consists of flat copper ribbon, the shunt winding being of wire. Both windings are placed on the pole entirely independent of each other, and either may be readily removed. Both shunt and series windings have free circulation of air upon all sides.

The type of set here illustrated is built in sizes from 6 by 8 engine to 16 by 14 engine, with output ratings of from 15 to 75 kilowatts, and weights of from 6,000 to 23,000 pounds. The engine frames are arranged so as to be fitted with cylinders of a maximum of 120 pounds pressure, or a minimum of 80 pounds pressure.

An Electric Railway for Bordeaux, France.

United States Consul Albion W. Tourgée writes from Bordeaux, as follows:



A GENERATING SET WITH HORIZONTAL ENGINE.

American manufacturers of electric railway supplies may find it to their interest to note the fact that the Tram and Omnibus Company, of Bordeaux, a company having the exclusive right to operate street cars and omnibuses in this city, whose charter had still several years to run, has recently sold out to a new company, which will operate under a new charter. It is understood that the old company is to receive 12,000,000 francs ($2,316,000) for its property and rights for the unexpired term of its charter, stockholders being allowed the option of stock in the new company on favorable terms instead of cash. The former company was English, with headquarters in London; the new one is French. The chairman of the board of directors is M. Mercet, 10 rue de Londres, Paris. It is understood that the present managing director, M. Bretherton, will continue to hold the same position under the new management. As the legal formalities are not yet complete, the terms of the new concession can not be given. It is understood, however, that they require an immediate increase of the service in the city and vicinity, and that the new company will at once proceed to substitute electric power for horse-power, which has been used heretofore. Information can be obtained by addressing M. Bretherton, managing director, Tram and Omnibus Company, rue Tivoli, Bordeaux, France.

WESTERN ELECTRICAL TRADE NEWS.

The Hart & Hegeman Manufacturing Company's western representative, Geo. S. Searing, says: "We are having an unusual trade in Hart switches and have recently been receiving some large orders. The Hart snap flush switch is a particularly good seller."

The Woods Motor Vehicle Company, of Chicago, formerly the Fisher Equipment Company, having increased their capital stock to ten million dollars, are contemplating extensive plans to enlarge their facilities. A new factory is projected which, when built, will more than double their manufacturing capacity.

Mathias Klein & Son, 87 and 89 West Van Buren street, Chicago, have been enjoying a large business supplying the demands made upon them for construction tools, of which their line is very complete. Klein's climbers have been shipped to customers in large quantities. They will mail their new catalogue free on application.

The Victor Telephone Manufacturing Company are now comfortably situated in their new quarters at 203-207 South Canal street, Chicago. The change gives them about eight times the former floor space and makes them one of the largest and most modern telephone manufacturers in the United States. Manager Blaine states that they have a large amount of work on hand, and that they are getting a very good share of the business.

Electric Motors on Board Ship.

A paper on Electrical Machinery on Board Ship, by Mr. A. Siemens, was read at the British Association's recent meeting in which the author stated that direct driving was now generally preferred, and expressed an opinion that the type of generating plant now in use on board ship had reached a stage of development which would be improved, but not materially altered. To prevent the magnetic field of the dynamos affecting ships' compasses, "ironclad" dynamos and double wires—one for the return current—were used. These conductors formed the most valuable part of the system of electrical installation for power purposes on a man-of-war. The superiority of the electric motor over small steam engines or hydraulic distribution of power was dwelt on by the author. The two latter systems necessitated a network of piping all over the ship, which was difficult to arrange neatly, and gave endless trouble through leakage. The reason that the use of electric motors had not been more extended on board ship was due to the variation of the load that accompanied the working of most auxiliary machinery. In the case of the winch, for instance, it frequently happened that the strain on the cable increased sufficiently to stop the movement of the winch. This would cause the current through the electric motor to rise to an extent that might seriously injure the machine. It was impossible to overcome this by a fuse, as the interruption of the current would allow the strain to be taken off the winch, whereas in most nautical operations it was necessary to keep the strain on. To overcome this difficulty, shunt-wound motors might be used. These could be kept running continuously, the drums of the winches being operated through friction clutches, or special cutouts could be applied in connection with series-wound motors. Through these cutouts the current through the motors was not interrupted altogether, a by-pass taking a safe current. Examples of working a steering gear and rudder indicator were given. The suggestion that the main engines of a ship should be electrical motors was rejected as impracticable whether accumulators or steam driving, on the Heilmann principle, were adopted. A 6,000-ton ship propelled by 8,000 initial horse-power would take 150 hours to cross the Atlantic, and that would be equal to 1,200,000 horse-power-hours. Fairly efficient accumulators gave 10 watt-hours per pound, so that a horse-power-hour could be obtained for 75 pounds of accumulators. The ship would therefore need 40,000 tons of accumulators.

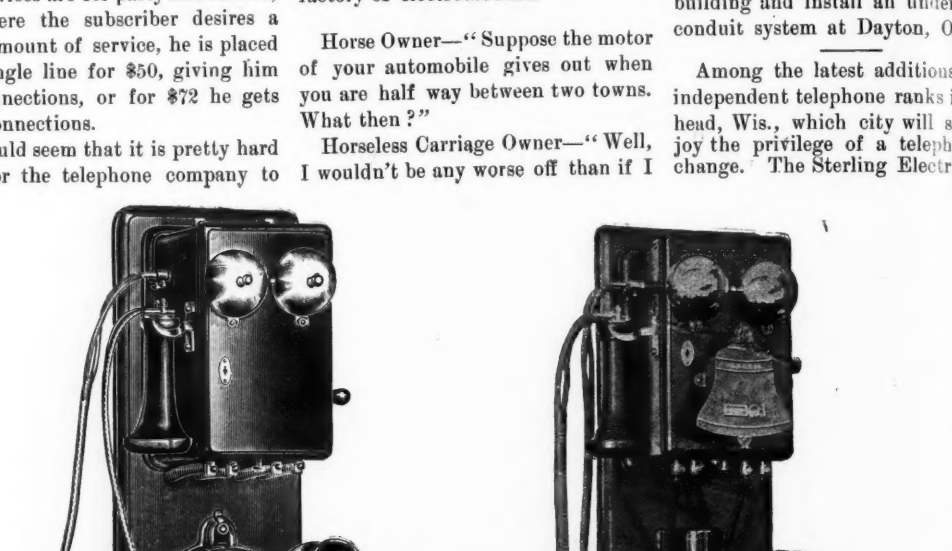
Automatic and Registered Telephone Service.

The Southern New England Telephone Company, of New Haven, Ct., are the designers of the automatic telephone instrument illustrated herewith. It is manufactured by the Gray Telephone Pay Station Company, at Hartford, Ct. It consists of a small iron box, a half bell in shape, which is attached to the backboard in place of the long-distance transmitter coil box. It contains the coil, also the receptacle for 5 and 10-cent pieces or tokens to correspond, and is locked by a Yale key. On the top of this box is a slot for 5 and 10-cent pieces. This form of instrument is used at stations out in the country, at stations remote from the central, and is placed for the subscriber on a metallic copper circuit, at the rate of $18 per year in advance. This covers the rental of the instruments, the printing of the subscribers name in the quarterly directory, and gives his inward connections to him without additional cost to him. For each outward connection to subscribers of the exchange a charge of 5 cents is made; to subscribers in the state beyond the limits of his exchange for the regular charge of 25, 15 or 10 cents, the toll being deposited at the time connection is given, if the desired subscriber is obtained. This style of service has become very popular in the company's country districts. They have placed some 1,500 new stations during the last two years.

The Southern New England Telephone Company have another form of measured service which is termed register service. It is nothing more or less than the regular long-distance wall set, with a small bell-shaped iron box, screwed to the front of the magneto bell. It, like the other, was designed by Mr. E. B. Baker, general superintendent of the company, and is made by the Gray people. It has no slots and does not require any money to be deposited. It is operated by a Yale key, and after the party called has been obtained, the subscriber is directed to give a signal. This may be done by making one revolution of the key, which strikes a gong contained in the box, and at the same time operates an indicator on the front of the box, similar to those used in an electric car. This style of service is furnished within city limits, the subscriber being charged $25 per year, which covers the rental of the instrument, his name in the directory, and his inward service, as well as 380 local connections outward, all to be used during his contract year. Connections in excess of 380 are charged for at the end of the contract year, at the rate of 4 cents each. These prices are for party line service, but where the subscriber desires a larger amount of service, he is placed on a single line for $50, giving him 760 connections, or for $72 he gets 1,800 connections.

It would seem that it is pretty hard work for the telephone company to be beaten by a non-subscriber from these stations, as a subscriber can take the key out of the box which will prevent any one getting an outward connection therefrom, but if he leaves his key in the box, and the instrument is used by a non-subscriber, the connection is registered against him.

This service has been quite popular, as it enables a subscriber to keep his own record, and note just what he is doing. The company has in use between 1,500 and 2,000 of these instruments. In addition to the automatic and register service, all the company's public stations, between 300 and 400, are equipped with the regular Gray automatic instrument, having 5-cent, 10-cent, 25-cent, 50-cent and $1 slots.



FIGS. 1 AND 2.—AUTOMATIC AND REGISTERED TELEPHONE SERVICE INSTRUMENTS.

AUTOMOBILE NEWS.

The Woods Motor Vehicle Company, of Chicago, has leased a five-story building at 547-551 Wabash avenue, and will equip it for a manufactory of electromobiles.

Horse Owner—"Suppose the motor of your automobile gives out when you are half way between two towns. What then?"

Horseless Carriage Owner—"Well, I wouldn't be any worse off than if I were half way between two towns with a horse and buggy and the horse should die."—*Chicago Tribune.*

He—"How do you like your new automobile? Is it hard to manage?"

She—"Oh, no. The only trouble I have is that somehow I can't break myself of saying, 'Get up!' when I want to start the thing, and 'Whoa!' when I want the machinery to stop."—*Automobile Magazine.*

David Wolfe Bishop left Lenox, Mass., on October 3 for New York on an automobile, to establish a record to New York. He has a new machine capable of making twenty miles an hour over country roads. He took the Hudson River route, stopping at Poughkeepsie and other towns on the way.

Telephone News .....and Comment

The Central Union Telephone Company will erect a new exchange building and install an underground conduit system at Dayton, Ohio.

Among the latest additions to the independent telephone ranks is Brodhead, Wis., which city will soon enjoy the privilege of a telephone exchange. The Sterling Electric Company, of Chicago, will furnish the switchboard and office equipment.

An ordinance has been passed granting a franchise to Geo. J. Huffman and C. L. Cassingham to construct and operate a telephone line at New Philadelphia, Ohio.

The Automobile Magazine.

Under the above title a new technical journal has entered the field, and if it fulfills the promise of its initial number, will certainly deserve success. The *Automobile Magazine* is, as its name indicates, of the usual magazine form, and contains about a hundred pages of reading matter, plentifully illustrated and well printed. The new magazine is published by the United States Industrial Publishing Company, of New York.

LEGAL NOTE.

In the case of Tesla Electric Company, of New York city, vs. Scott & Janney *et al*, of Philadelphia, before the United States Circuit Court for the Eastern District of Pennsylvania, Judge McPherson rendered an opinion on September 27. An abstract of the court's opinion follows:

The defendants are charged with infringing letters patent Nos. 511,915 and 555,190, granted to the plaintiff as assignee of Nikola Tesla. The patents relate to electro-magnetic motors operated by alternating currents of electricity, and the points in controversy can not be understood without a brief preliminary consideration of certain properties manifested by the electric fluid. I condense the following account from the brief of plaintiff's counsel, understanding that no objection is made by the defendants to the accuracy of the theory now to be repeated:

Suppose two coils of insulated wire, A and B, to be wound in opposite directions and placed at two points on a soft iron bar, C. If a current of electricity be passed through either coil, or through both coils, the bar will become a magnet for the time being. If a current of given direction be passed through coil A alone, a north pole will be thus produced at one end of the bar, and a south pole at the other end. The same current passed through coil B alone will also produce north and south poles, but in reversed positions. If the same current be passed through both coils at the same time, a north pole will be produced in the bar midway between the coils. If the current through coil A is weaker than the current through coil B, the stronger current will have more influence upon the position of the pole, and will fix it nearer to A than to B. If the stronger current be shifted from A to B, the position of the pole will also be shifted to a point nearer to B than to A; and thus, by increasing and decreasing from zero to maximum the relative strength of the currents through the respective coils, the pole may be made to travel backward and forward from one end of the bar to the other. If, therefore, a magnetic bar or armature D be suspended near the bar and be free to move, it will inevitably follow the pole in this backward and forward movement. The bar need not be continuous, and need not be straight; it may be bent into the form of a ring. Soft iron forms a better path for the magnetic lines that flow from the coils than the air affords, but the lines will pass through the air for some distance, and therefore the middle section of the bar may be removed, leaving only the sections that are surrounded by the coils, or the bar may be removed altogether. In either event, the armature D will still be affected magnetically, while its movement may be less obstructed. The partial removal of the bar may, therefore, be an important physical advantage. The movement of the armature will depend upon the relative strength of the magnetizing influences of the coils, and upon the forces that may be set in motion by these influences.

If, therefore, the pole is to shift uniformly, and is thus to produce a uniform magnetic attraction, the electric current passing through each coil must vary in strength, and must vary uniformly. There must be a definite relation between the two currents, and this relation must be constant in all the changes in strength that the currents undergo. Tesla discovered—and the discovery has been of vast importance—how to use alternating currents of electricity so as to bring about this uniform shifting of the poles or attractive forces in a motor, and thus to cause the rotation of an armature, and the consequent transmission of power. . . .

I think . . . that the defendants' motor infringes all the disputed claims of the patents in suit.

The last defense avers that the plaintiff has assigned all its interest in the patents in suit to the Westinghouse Electric Company by an agreement executed July 7, 1888; and, therefore, that the present action can not be maintained, because the Westinghouse Company has not been joined as a party complainant. This defense was not taken by the pleadings, as it should have been in order to bring it properly before the court, and under the circumstances I am not disposed to give it any weight. Assuming the agreement of July 7 to have the effect contended for, the only result of dismissing the bill would be to renew the controversy in another proceeding, where the same evidence would be heard and the same conclusion would be reached. The failure to make the Westinghouse Company a party plaintiff, if such a joinder was necessary, is a formal defect that has no bearing, so far as has been made to appear, upon the substance of the controversy. But I think it would be reasonable to protect the defendants from the possibility of being called upon to answer that company for the same cause of action, and I understand the plaintiff to agree that the court should take that course. If, therefore, within 20 days from the date of filing this opinion the plaintiff shall file with the clerk a stipulation, executed by the Westinghouse Electric Company, agreeing to be bound by the decree in all respects as if it had been originally a party plaintiff, the decree prayed for by the bill will be entered.

The Granite City, Venice & East St. Louis, Ill., Railway Company, which proposes to build an electric line between the points named, has been incorporated, with $125,000 capital stock, with headquarters at Venice. E. J. Spence, Frederick E. Allen and J. S Tritle, incorporators.

Electrical Men at the International Yacht Races.

The electrical fraternity has evinced great interest in the races between the Columbia and Shamrock. Several parties have been formed to witness the contest, among them being one with Mr. A. M. Young as host, who invited a number of his friends to witness the third race from the Sandy Hook, a boat chartered by the Union League Club, of New York. Mr. Charles A. Moore, of Manning, Maxwell & Moore, also entertained a party both weeks; and last Saturday Mr. H. L. Shippy, of the John A. Roebling's Sons Company, entertained forty-five guests on the steam yacht Nooya, which he had chartered for the series of races.

Storage Battery Traction on the Erie Canal.

It was reported in New York city on Monday of this week that the Executive Committee of the Erie Canal Electric Traction Company had adopted the storage battery system for use as its motive power, subject to the approval of the Superintendent of Public Works.

It is understood that the method of operation will be as follows: An electric traction engine will run along the towpath of the canal. It will tow a canal boat filled with storage batteries of sufficient capacity to furnish current for the traction engine and for a reasonable number of canal boats with cargoes towed behind the battery boat.

ELECTRIC RAILWAY NOTES.

H. M. Chase, S. C. Smith and E. J. King are seeking a franchise for a new electric line at Galesburg, Ill.

The County Central Street Railway Company has been incorporated to build an electric railway five miles long in Northampton County, Pa. Capital stock, $30,000.

The Richmond, Va., Railway and Electric Company will make extensive improvements. It is proposed to establish an electric line between Richmond and Petersburg.

Patrick J. Barrett is at the head of a movement to secure a franchise from the city of Omaha, Neb., for an electric or steam rapid transit company to operate on numerous streets within the city limits.

The Buffalo & Erie Electric Railroad Company, a street surface road—capital stock, $1,000,000—has been incorporated to build a road from Buffalo to Erie, Pa., a distance of 70 miles. The principal office is in Buffalo.

The Columbia, Tenn., & Mount Pleasant Railway Company will be incorporated to build an electric railway. Boston capitalists will put in the road, providing the franchise and right of way is given and $30,000 subscribed.

BUSINESS NOTES.

The Crefeld Electrical Works, of Saylesville, R. I., has been bought by the American Electrical Works, and has removed the plant to a substantial new three-story brick building, 130 feet by 60 feet, adjoining the American Electrical Works' factories at Phillipsdale, R. I.

Day's Kerite, W. R. Brixey, manufacturer, New York, has issued a particularly attractive catalogue relating to its insulating wires and cables. A number of new and artistic illustrations are presented. The headquarters of this company are at 203 Broadway. George F. Porter, general manager.

The Central Electric Company, over the signature of Mr. George A. McKinlock, president, issued an invitation to its friends who attend the Fall festival at Chicago, lasting from October 4 to 11, to make its house their headquarters. The invitation contained illustrations of the new government building as it will appear when completed, the corner-stone of which was laid by President McKinley on October 9.

General Incandescent Arc Light Company, New York, has recently issued several bulletins and pamphlets, including a tasty price list of Tailleur underground apparatus, of which they are exclusive manufacturers. The ELECTRICAL REVIEW has received a copy of circular descriptive of the "G. I." arc lamp hanger reel, recently illustrated in these columns. This device has already attracted considerable attention. A neat folder which has just made its appearance summarizes the products of the company, which cover a surprisingly large range. New bulletins on arc lamps and on switches are announced as in preparation.

The Manhattan General Construction Company, of Newark, N. J., manufacturers of the Manhattan arc lamp, is meeting with marked success in the introduction of the Manhattan series alternating-current enclosed arc system. Among some of the contracts which were closed recently are for 850 lamps and nine regulators for the San Gabriel Electric Company, Los Angeles, Cal.; one regulator and 25 lamps for the People's Gas and Electric Company, Peoria, Ill.; one regulator and 35 lamps for the Electric Light Company, of Hot Springs, Ark.; three regulators and 117 lamps for the Middlesex & Monmouth Electric Company, of Matawan, South Amboy and Keyport, N. J. The company is operating its factory at Newark night and day in an endeavor to catch up with its orders.

ADVANCE INFORMATION

New Electric Railways.

ATLANTIC CITY, N. J.—The City Council has passed an ordinance granting a franchise to the Atlantic City Electric Railway Company, Levi Albertson, president. This corporation will now proceed to build and operate four miles of trolley road from the beach on South Carolina to Atlantic, down Rhode Island and thence to the Inlet.

SCRANTON, PA.—A movement is on foot to construct an electric railway between Lake Winola and Scranton via Mill City, Shultzville and Clark's Summit. C. E. Frear is the principal promoter of the proposed road.

GREENVILLE, IND.—It is proposed to build a connecting link between the Goshen & Indiana Electric Railway and the Kendallville, Albion & Logansport line by building a line from North Webster to Emma, Lagrange County, passing through Cormwell and Ligonier.

NORTHAMPTON, MASS.—A temporary organization has been formed for the construction of an electric road from this city to Holyoke, passing through East Hampton. Ex-Mayor O'Donnell, of Northampton, is president of the temporary organization, Robert L. Warner, of Brookline, treasurer, and Seward Pearson, of Philadelphia, manager of construction. It is estimated that it will cost $200,000 to build the road.

KENNEBUNKPORT, ME.—The new electric road between Sanford and Cape Porpoise has been completed, and is now in operation.

FREDONIA, N. Y.—The Fredonia & Lilydale Electric Railroad, with a capital of $150,000, has been incorporated. It is to be operated through the village of Fredonia to and through the assembly grounds at Lilydale, a distance of about seven miles.

MONROE, MICH.—A thirty-year franchise has been granted to Messrs. Jackson & Harrah, of Detroit, to operate an electric line between this place and Toledo, the work to be commenced not later than November 15, 1899, and the road to be completed by August 1, 1900.

COLLINSVILLE, ILL.—The Collinsville & Troy Railroad Company has been incorporated to construct electric railway; capital, $2,500; incorporators, D. M. Browning, H. S. Browning, W. S. Forman, of East St. Louis; E. C. Donk, O. W. Erickson, of St. Louis.

KAUKAUNA, WIS.—The East Shore Electric Railway and Light Company has been incorporated; the capital stock is $25,000; the incorporators are D. J. Brothers, William Breier and H. J. Mulholland of this city, and Charles Smith of Fond du Lac.

ALBANY, N. Y.—The Buffalo & Erie Electric Railroad, a street surface road with a capital stock of $1,000,000, has been incorporated with the Secretary of State to build a railroad from Buffalo to Erie, Pa., seventy miles; it will parallel the Lake Shore road. The directors are C. V. Boughton, A. C. Schmidt, Thomas C. Fremyear, Paul Herner, W. A. Calhoun, A. Schmidt, Sr., J. F. Weber, H. P. Queal, all of Buffalo, and W. W. Cole, of Elmira, who have each taken ten shares.

DANVILLE, VA.—The City Council, having passed an ordinance granting a new franchise to the Danville Street Car Company, a syndicate headed by William J. Payne has closed an option by which they become the purchasers of the property. This syndicate will expend $250,000 in equipping the line, extending it to the north side of the river and on other streets on the south side. They will take possession and begin the work at once.

New Incorporations.

PHILADELPHIA, PA.—The Robert McClellan Electric Railway Company has been incorporated. Capital, $25,000.

CAMDEN, N. J.—The Drawbaugh Electrical Company, principal office, No. 106 Market street, has been incorporated to manufacture electrical supplies; capital, $25,000; incorporators, Samuel L. Kent, Clifton Heights, Pa.; Charles A. Gladding, Philadelphia; Elias Mosier, Pensauken, N. J.; Brenton N. Newcomb, Philadelphia.

CHICAGO, ILL.—The Abatis Electric Manufacturing Company has certified to a change of name to Acme Telephone and Electric Company.

CHICAGO, ILL.—The Knox Automotoneer Company has been incorporated to deal in mechanical and electrical devices; capital stock, $25,000; incorporators, J. B. Woodruff, G. W. Knox, M. B. Starring, all of Chicago.

WILMINGTON, DEL.—The Delaware Trust Company has filed with the Secretary of State a certificate of incorporation for the Rio Plata Electric Company; capital stock, $100,000. The object of the company is for the purpose of electric lighting in Porto Rico, and the principal office is in the Delaware Trust Company's Building in Wilmington. The incorporators named are Spencer Crosby, Philadelphia; Philip T. Penrose, Philadelphia, and Ramon Valdes Bayamon, Porto Rico.

BUFFALO, N. Y.—The New Motor Company has been organized, with a capital of $25,000, to manufacture steam, air, gas, gasoline and other motors, trolley wheels, bases and heads, emery wheels and boring machines. The directors for the first year are Samuel Wilkinson, E. L. Pixley and William M. Hoffman.

PORTLAND, ME.—The Equitable Autotruck and Power Company has been organized to manufacture and deal in electric car brakes and other electrical supplies; capital, $2,000,000. W. J. Knowlton, Portland, is president, and William E. Pearson, Boston, treasurer.

PHILADELPHIA, PA.—The International Electric Car Lighting Company has been incorporated to manufacture and deal in patent apparatuses for lighting; capital, $110,000; incorporators, W. S. Dunlap, C. E. Lent, J. E. Lewis, T. R. Heller, E. A. Ryan, all of Philadelphia.

SUMTER, S. C.—The Sumter Telephone Manufacturing Company has been incorporated. The corporators are R. M. Wallace, D. D. Lee, C. G. Rowland, F. C. Manning and C. T. Mason. The capital stock, $50,000. The company proposes to manufacture and sell telephones.

NORWOOD, MICH.—The Norwood Electric Company has been incorporated; capital, $15,000; incorporators, J. E. Smith, G. F. Willett, G. S. Winslow.

CHICAGO, ILL.—The National Autophone Company has been incorporated to manufacture and deal in telegraphic and telephonic instruments, etc.; capital, $500,000; incorporators, Frank B. Taylor, William P. Hapeman, Daniel W. Fishell.

BALTIMORE, MD.—The Automatic Construction Company has been incorporated to manufacture and deal in automatic telephone switches; capital, $100,000; incorporators, E. Brady, M. J. Mitchell, J. Hall, L. McMullen, J. A. Katzenberger, all of Baltimore.

DETROIT, MICH.—The J. R. Pearson Company has been formed to deal in electric fixtures, mantels, etc. The capital stock is $10,000. The shareholders are Justice R. Pearson, Frank H. Crawford, Arthur J. Franklin.

New Telephone and Telegraph Companies.

SIOUX CITY, IOWA—The Iowa, Dakota & Minnesota Telephone Company has been incorporated, with a capital of $500,000. Incorporators, T. A. Potter, S. P. Hesley, B. C. Way, Britt, Iowa; Joe Kirby and J. E. McMahan, Sioux Falls.

GADSDEN, ALA.—The Alabama & Georgia Long Distance Telephone Company is now building a new line into Alexandria Valley, in Calhoun County. This company now has branches in Calhoun, Cherokee, DeKalb, St. Clair and Marshall counties.

MASSILLON, OHIO—The Farmers' Telephone Company's plant at this place and the toll lines to various villages near by have been purchased by the United States Telephone Company, of which Henry A. Everett, of Cleveland, is president. The consideration was about $20,000.

FREEPORT, L. I.—The South Shore Telephone Company has decided to extend its system from Mineola to New Hyde Park, East Williston, Albertson and Roslyn. These lines will connect with the company's south side system.

DECATUR, NEB.—The Nebraska Telephone Company has now completed its line to this place, and Decatur will soon have telephone connection with the rest of the state. C. E. Barlow has been appointed local manager.

SPRING VALLEY, N. Y.—The New York Telephone Company are improving their line in Rockland County. A new copper line is being run from Haverstraw to Nyack. Connections will be made with Valley Cottage and Congers. A cable is being laid from Dobb's Ferry to Sneden's Landing, which will give Rockland and Westchester direct connections.

RICHMOND, KY.—Messrs. J. H. & C. S. Powell, of the city, who recently put in telephone systems at Owingsville and Flemingsburg, will in a few days begin the erection of a telephone line from Mt. Sterling to Owingsville, probably extending it to Flemingsburg.

COLUMBUS, OHIO—The Miami Valley Telephone and Telegraph Company, with headquarters at Hamilton, has been incorporated by Will Christy, F. J. J. Sloat, M. J. Mandelbaum, Peter Schwab and W. C. Shepard, with $10,000 capital, to operate telephone and telegraph lines in Butler, Montgomery, Hamilton and Warren counties, with termini at Dayton and Hamilton.

Electric Light and Power.

DANIELSON, CT.—The Electric Light Company at this place has been organized, and the following officers were elected: President, H. S. Pratt; vice-president, J. W. Dobbin; treasurer, H. C. Shaw; secretary, Arthur G. Bill.

HENRIETTA, TEX.—A deal is being closed for the construction of an electric light plant, to be in operation in the next thirty days.

WAXAHACHIE, TEX.—The electric light company is preparing to make extensive improvements on the system in this city. Superintendent Kelly has just purchased 10,000 pounds of wire, which will be used in extending the lines, replacing the old wires, and otherwise adding to the efficiency of the system.

MINOOKA, PA.—The Lackawanna Electric Light and Power Company has been incorporated, with a capital stock of $6,000.

NEW ALBANY, IND.—The Jeffersonville City Council has contracted with the Wayne Construction Company, of Chicago, for an electric light plant for $40,000.

Increase of Capital.

KANSAS CITY, MO.—The Chicksaw Telephone Company has increased its capital stock from $25,000 to $50,000.

SIOUX CITY, IOWA—The Sioux City Traction Company has increased its capital stock $200,000, making the total now $1,200,000.

INDIANAPOLIS, IND.—The capital stock of the Indianapolis & Greenfield Rapid Transit Company was increased from $100,000 to $400,000.

ST. LOUIS MO.—The St. Louis Transit Company has increased its capital from $3,000 to $20,000,000.

Kindred.... ...Interests

Poles, cross-arms, brackets, pins, ties are offered for prompt shipment by the Eccleston Lumber Company, 29 Broadway, New York.

The Western Electric Company carries in stock a complete supply of the Nungesser dry chloride of silver and closed circuit batteries.

The swinging ball lightning-arrester which has been in successful use for many years, is now sold by James L. McIntosh, 141 Broadway, New York.

The Jandus Electric Company, Cleveland, according to its sales agent, Mr. Bailey Whipple, is turning every wheel in the shops to fill orders for the Jandus arc lamps.

The Fort Wayne Electric Works, Fort Wayne, Ind., has just issued new bulletins illustrating and describing the Wood alternating-current dynamos for high and low frequencies.

The New York & Ohio Company, at Warren, Ohio, is soon to occupy the new factory which has been constructed as an addition to the present plant for the manufacture of the Packard transformers.

The American Electrical Heater Company, 197 River street, Detroit, Mich., has issued an illustrated folder giving valuable information in regard to their extensive line of electric heaters for all purposes.

The Ironclad Resistance Company, Westfield, N. J., will be glad to send, gratuitously, a copy of their new catalogue of dimmer, rheostatic devices and apparatus of this character, of which they are manufacturers.

McLaren & Goodchild, 24 Boudinot street, Newark, N. J., are making a new incandescent lamp known as the "Midnight Glow." This company say that they are not in any trust or combination, and for that reason are able to quote remarkably low prices.

The "Peerless" transformer, made by the Warren Electric and Specialty Company, Warren, Ohio, is receiving excellent indorsements by those who are using it. This company is also having the largest call for the "Peerless" incandescent lamps which they have ever known.

Electrical heating apparatus is described and illustrated in a new catalogue issued by the H. W. Johns Manufacturing Company, 100 William street, New York. This company now is making electrical heaters for household, store, office, street-car, steamship and special uses.

The Williams-Abbott Electric Company, Cleveland, Ohio, is about to place on the market a complete telephone exchange instrument, for which many advantages are claimed. This company, heretofore, it will be remembered, has confined its work to the making of telephone generators and telephone parts.

The Michigan Electric Company, Detroit, Mich., which, since the completion of their new establishment on Woodward avenue, has become known to the electrical trade as "Michigan's great electrical supply house," are the sales agents in the West for the "Imperial" incandescent lamps, made by Bryan, Marsh & Company.

The Buckeye Electric Company, makers of incandescent lamps, Cleveland, Ohio, has completed the enlargement of facilities so that soon the company will be producing something over 10,000 lamps daily. This move has been necessitated because of the unprecedented demand for incandescent lamps during the past six months.

The North Electric Company, Cleveland, Ohio, is developing a most comprehensive line of telephone apparatus, including switchboards and telephone specialties. This company has an excellent combination of capital and experience for the telephone field, and is likely to rank among the largest and most successful in this line of manufacturing.

The Manhattan General Construction Company, Newark, N. J., and 11 Broadway, New York, are now manufacturing in large numbers the new alternating-current series "Manhattan" arc lamp. The results which have been accomplished in the construction of this lamp and the methods of its operation are worthy of study by lighting experts.

The C. J. Toerring Company, 1035–1037 Ridge avenue, Philadelphia, are manufacturing a new arc lamp of the enclosed type, for which a number of advantages are claimed. They are also soon to have perfected a new constant-current series arc lamp. This company informs us it is desirous of placing a few agencies with desirable companies.

The Pairpoint Manufacturing Company, of New Bedford, Mass., with which is consolidated the Mt. Washington Glass Company, of the same city, are advertising glass for electrical purposes. They make a complete line of incandescent and arc shades and globes, incandescent bulbs and glass tubes. They will send descriptive catalogues on application.

The Electric Appliance Company, Chicago, are mailing upon application numerous copies of their Packard transformer catalogues. These pamphlets, besides giving prices, contain articles on "Transformers and Their Profitable Use," by Dugald C. Jackson, C. E., and on general instruction for testing transformers. They are full of valuable data for the transformer user.

The Fort Dodge Telephone Company, of Fort Dodge, Iowa, has just placed an order with the Sterling Electric Company, of Chicago, for its sixth section of 100 numbers each, switchboard and exchange equipment. This company began business less than a year ago with 300 subscribers, and is an example of what can be done in the independent telephone field when first-class service and apparatus are provided.

The Galvanic Metal Paper Company, 725 Broadway, New York, is introducing a new metal brush for which surprising results are claimed. It is composed of thin layers of carbon and copper in alternation and which, by an electrical process, are rendered, it is claimed, into an absolute chemical affinity. The layers are so arranged that a layer of metal and a layer of carbon are so closely united as to form one flexible sheet.

The Falcon Electric Manufacturing Company, 432–434 West Seventy-first street, New York, are now operating a splendidly equipped factory, with new and elaborate mechanical facilities. Mr. H. O. Swoboda, whose work as a designer with the General Incandescent Arc Light Company and elsewhere has made him well known in the electrical field, will fill a similar capacity for the Falcon company. They are already making switchboards and switchboard apparatus, panelboard flush receptacles, and are adding to this line of electrical apparatus and equipment.

Trotter's Mona Manufacturing Company, Limited, manufacturers of the well known commutator compound, has removed its offices from 65 West Broadway to more commodious quarters at 320 Broadway, New York, where Professor Trotter will be pleased to receive his friends and all interested in commutator compound. Professor Trotter, after years of experiment, has perfected a composition which is said to effectually neutralize the explosive gases of petroleum, and is a product of petroleum. A public demonstration is to be given.

The Michigan Electric Company, of Detroit, Mich., received recently an order from the G. P. Magann Air-Brake Company for one 5 horse-power 600-volt Western Electric semi-enclosed motor with back gearing, which the company will use in operating an air compressor they are to furnish the Detroit, Rochester, Romeo & Lake Orion Railway. The Michigan Electric Company has also sold one 10-horse-power Western Electric 600-volt semi-enclosed motor to Charles Stinchfield, of Pontiac, Mich., which is to be operated from the railway circuit on voltage varying from 400 to 750, and will be used for driving a pump.

The Berlin Iron Bridge Company, of East Berlin, Ct., has the contract for furnishing the structural steel work for three buildings for the Ottawa Carbide Company, of Ottawa, Canada. The buildings are from 3 to 5 stories high, and consist of a furnace building, 80 feet wide and 286 feet long; a grinding-room, 38 feet wide and 80 feet long, and a breaking-room, 35 feet wide and 80 feet long, and 2 stories high. The floors are carried on steel beams and columns, and the flooring is steel plate. The trusses have a clear span and the roofing is corrugated iron. The bins for the storage of material are all of plate-iron. No woodwork is used anywhere in the construction of the buildings.

Eugene Munsell & Company and the Mica Insulator Company, of Chicago, will make a combined exhibit at the street railway convention in that city, having engaged a space of 200 square feet near the entrance of the exhibition building. This exhibit will consist of mica in its natural state and in its various forms for electrical insulation, also stamped mica segments and washers, both India and amber. Very large specimens of mica will be shown, which will be of interest to all electrical engineers and street railway managers. The exhibit of the Mica Insulator Company will consist largely of micanite rings, segments, tubes, troughs, cloth, paper, etc. The exhibit will be in charge of Mr. Charles E. Coleman, who has charge of their western business. The companies' Chicago offices are located at 117–119 Lake street, where the electrical fraternity will be welcome during their short stay in Chicago.

WANTED—SEVERAL BRIGHT AND HONEST persons to represent us as Managers in this and close by counties. Salary $900 a year and expenses. Straight, bona-fide, no more, no less salary. Position permanent. Our references, any bank in any town. It is mainly office work conducted at home. Reference. Enclose self-addressed stamped envelope. THE DOMINION COMPANY, Dept. 3, Chicago.

KLEIN'S

CLIMBER'S LINEMEN'S TOOLS
Catalogue Free. Send for one.
MATHIAS KLEIN & SON,
87-89 W. VAN BUREN STREET, CHICAGO, ILL.

STEREOPTICONS MAGIC LANTERNS and SLIDES CONDENSED CATALOGUE FREE RILEY BROS. 16 BEEKMAN ST. NEW YORK.

H. C. ROBERTS
ELECTRIC SUPPLY CO.
831 ARCH ST. PHILADA. PA.
THE BEST GOODS AT FAIR PRICES.

Electrical.. Patents.

[Specially reported for this journal by E. S Duvall, solicitor of patents, Loan and Trust Building, Washington, D C. Copies of any patent may be secured for 10 cents each.]

ISSUED SEPTEMBER 26, 1899.

633,690 Apparatus for reproducing motion; A. Franke, Berlin, Germany—Consists of a transmitter having two sets of multiphase windings for producing oppositely rotating fields in the transmitter, a receiver having two sets of multiphase windings for producing oppositely rotating fields therein, and electrically associated armatures subjected to the influence of the fields of the transmitter and receiver.

633,695 Motor meter for three phase currents; G. Hummel, Munich, Germany—Consists of a pair of current or series coils and a pair of tension or shunt coils, means for shifting the phase of the currents in each tension or shunt coil backward 30 degrees with respect to its tension and rotating means inductively acted upon by the coils and adapted to actuate a registering mechanism.

633,771 Switch for electric circuits; G. Wright, Wilkinsburg, Pa Consists of a base having three contact terminals, an arm and an operating lever pivoted to the base and having a lost motion connection with each other, a double-ended laminated contact member and a locking head pivoted to said arm and means carried by the operating lever for moving the locking head into locking position as said operating lever reaches either of its extreme positions.

633,772 Automatic circuit-breaker; G. Wright, Wilkinsburg, Pa.

633 773 Circuit-breaker; G. Wright, Wilkinsburg, Pa.—Consists of the stationary and movable contact terminals, of toggle levers for closing the breaker and constituting the sole means for locking the same, and knife-edge bearings for said levers.

633,801 Means for utilizing galvanic cells or batteries; A. de Castro, New York.

633,826 Electrically operated typewriter; W. R. Fox, Grand Rapids, Mich.—Consists of the type, type bars and links, the keys, the plurality of rock shafts horizontally arranged, one for each key, and the pivoted bell-crank levers, a connection between each rock shaft and one of said bell-crank levers to operate the same to position one of the links on the depression of a key, and an electrically operated device to actuate the positioned links.

633,829 Static electric machine; J. Gallegos, San Jose de Guatemala, Guatemala.

633,855 System of electrical distribution; B. G. Lamme, Pittsburgh, Pa.

633,856 Distributed winding for electrical machines; B. G. Lamme—Consists of a slotted core, a continuous multipolar windings having the middle conductor, or one of two middle conductors, for each of one or more phases for each pole connected at its respective ends to the nearest side conductors of said phase or phases corresponding to the adjacent poles.

633,857 Dynamo-electric generator; B. G. Lamme, Pittsburg, Pa.

633 858 Field-magnet coil for electrical machines; B. G. Lamme, Pittsburgh—A field magnet for electrical machines comprising a plurality of concentric divisions of copper strap bent edgewise, the turns of each division being separated by insulation and the several divisions having bare edges separated by air spaces.

633,886 Manufacture of electric-railway rail-bonds; T. J. McTighe, New York.

633,887 Electric-railway rail-bonds; T. J. McTighe, New York.

633,910 Machine for cleaning ships bottoms; J. Schnepf, New York.

633,920 System of electrical distribution; L. B. Stillwell, Niagara Falls, N. Y.

633,944, 633,945 Loom; W. H. Baker, Central Falls, R. I.

633,951 Timing device; W. M. Brown, Johnstown, Pa —A starting and stopping mechanism, and an engager carried and actuated by the time movement and adapted to positively move said mechanism to the position for stopping the time movement.

633,969 Automatic electro-magnetic friction brake; E. M. Tingely, Pittsburgh, Pa.

633,971 Car for train lighting system for electric railways; E. R. Hill, Wilkinsburg, Pa.

633,972 Current collector for electrical machines; B. G. Lamme, Pittsburgh, Pa.

ISSUED OCTOBER 3, 1899.

634,023 Electric signal for railways; T. H. Patenall, Easton, Pa.

634,057 Electric switch; William Ely, Providence, R. I.

634,085 Electric arc lamp; A. Hamacek, Sturgeon Bay, Wis.—A solenoid, a resistance device, an armature or plunger actuated by the solenoid, a carbon-carrier and a connected clutch, a counterbalancing-lever flexibly connected with the carrier and adapted to counterbalance the weight of the carrier, and a dashpot having its piston connected with the carrier.

634,095 Electric annunciator; C. E. Scribner, Chicago, Ill.

634,157 Electric arc lamp; J. M. Willard, Decatur, Ill.

634,165 Portable electrical drilling machine; A. L. Croneau, Paris, France.

634,169 Flexible electrical conduit or tube; E. T. Greenfield, New York—A flexible metallic conduit or tube constructed of spirally wound strips having their edges serrated and turned up and down.

WANTED—SEVERAL BRIGHT AND HONEST persons to represent us as Managers in this and close by counties. Salary $900 a year and expenses. Straight, bona-fide, no more, no less salary. Position permanent. Our references, any bank in any town. It is mainly office work conducted at home. Reference. Enclose self-addressed stamped envelope. THE DOMINION COMPANY, Dept. 3, Chicago.

35 VOLT AMMETER FOR STUDENTS' USE.

(Jewell Bearing and Aluminum Case.)

Adapted to primary and storage battery work.

List of schools using it mailed on application. The method of its use described in a circular just issued.

L. E. KNOTT APPARATUS CO.,
16 Ashburton Place, - BOSTON, MASS.

The New System OF EDUCATION Steam Engineering

Mechanical, Electrical, Civil and Mining Engineering; Architecture; Drawing; Surveying; Chemistry; Shorthand, Book-keeping and English Branches

TAUGHT BY MAIL.

Students qualified to pass examinations.

We have helped thousands to better positions and salaries. Send for free circulars, stating the subject in which you are interested.

THE INTERNATIONAL CORRESPONDENCE SCHOOLS,
Box 1003, Scranton, Pa.

Taught by Mail.

ELECTRICAL ENGINEERING,
Telephony, Telegraphy, X-Rays,
MECHANICAL ENGINEERING,
Elementary Mathematics,
MECHANICAL DRAWING, Etc.

This Institute endorsed by every prominent electrical engineer.

"I consider the Electrical Engineer Institute conducted by Messrs. Dyer and Martin to be of great value to those who desire an Electrical education." Thomas A. Edison

The Electrical Engineer Institute of Correspondence Instruction.
DEPT. N, 120-122 LIBERTY ST.
NEW YORK, N. Y.

Write for catalogue. State subject you wish to study.

The Best Education

is that which helps to
INCREASE YOUR SALARY.
AMERICAN SCHOOL OF CORRESPONDENCE
(Chartered by the Commonwealth of Massachusetts) is conducted by technical EXPERTS of world-wide reputation and devoted exclusively to
ENGINEERING { Steam, Electrical, Mechanical
WRITE TO-DAY for our "Handbook B" and Special Terms for October Enrolments.
American School of Correspondence
BOSTON, MASS., U. S. A.

POLES · CROSS-ARMS · TIES
BRACKETS, PINS
PROMPT SHIPMENT DIRECT FROM MILLS
SAVE BROKERAGES AND SEND US YOUR INQUIRIES
ECCLESTON LUMBER CO.
29 BROADWAY, NEW YORK

Motor Starting Rheostats
Motor Regulating Rheostats
Dynamo Field Rheostats
Theater Dimmers, Special Rheostats
Iron Clad Resistance Co., WESTFIELD, N. J. U. S. A.

H-P Enamel-Insulated Bridle Rings.

These Insulators are made of best quality drop forged iron and heavily enameled.

They are designed for carrying groups of Insulated Wires to and along the walls of buildings and distributing them to subscribers' offices.

New Wires can be readily inserted and old Wires removed from these Insulators without injury. Being strongly made, they will last indefinitely. They can be screwed into the most difficult places with the hand, and when desired can be unscrewed and used a din for other work. The cut is approximately half size.

JAMES S. BARRON & CO.,
Manufacturers of and Wholesale Dealers in GENERAL ELECTRICAL SUPPLIES,
24-30 Hudson Street, - NEW YORK.

KEYSTONE ELECTRIC CO.
High-Grade Dynamos and Motors.
B. N. SPERRY, Agent Central New York,
SYRACUSE, N. Y.

SUCCESSFUL ELECTRICIANS

are men of education. Success in the electrical profession is impossible without technical knowledge. You can obtain a thorough electrical education at home during your spare time at a cost so low that you will not notice the outlay. Complete courses by mail in

ELECTRICAL ENGINEERING,

ELECTRICAL STATION ENGINEERING, ELECTRIC RAILWAYS, ELECTRIC LIGHTING, TELEPHONY, TELEGRAPHY, ELECTRO-PLATING, MECHANICAL DRAWING AND DYNAMO-ELECTRIC MACHINE DESIGN. BEST TEXT-BOOKS FREE.

THE BEST, MOST THOROUGH AND PRACTICAL COURSES OF ANY CORRESPONDENCE SCHOOL IN THE WORLD. SEVEN YEARS OF EXPERIENCE IN TEACHING BY CORRESPONDENCE.

Write for illustrated circular B, sample pages of text-books, drawing plate and booklet of letters from students all over the world.

THE UNITED CORRESPONDENCE SCHOOLS, 154, 156, 158 FIFTH AVENUE, NEW YORK,
with which are incorporated The Correspondence School of Technology and the Institute for Home Study of Engineering.

HARDY LAMPS UNIFORM IN CANDLE POWER. UNIFORM IN WATTS PER CANDLE. PRICES RIGHT. PROMPT SHIPMENTS.
LAMP COMPANY, PITTSFIELD, MASS.

GET OUR NEW CATALOGUE.
BOSTON AGENTS: F. R. HOUDLETTE & SON, 138 Milk Street.

CREOSOTED WOOD CONDUITS
WILL LAST FOREVER. EASILY ACCESSIBLE. FOR UNDERGROUND WIRES. DO NOT GATHER MOISTURE. DO NOT SCRATCH CABLES.
THE MICHIGAN PIPE CO.,
298 N. Madison St., BAY CITY, MICH.

A National Rider never changes his mount.—National Cycle Mfg. Co., Bay City, Mich.